SCIENTIFIC AMERICAN

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H. M. S. BENBOW.

The new armor-clad barbette ship Benbow, built by the Thames Ironworks and Shipbuilding Company, was delivered on the 26th of August into the charge of Captain Buller, at the entrance of the Royal Albert Docks, and proceeded in charge of that officer to Chatham Dockyard, where she will receive her armament, preparatory to being put in commission. The Thames Company, which is contractor to the Government for the supply of both ship and engines, has been working early and late to complete its contract within the specified time, and Messrs. Maudslay, to whom the contract for engines has been sublet by the Thames Company, being also under contract to complete by date, in order that the vessel might steam from the works down the river.

The Benbow is one of the six vessels of the Admiral class, so called from bearing the names of six of our famous admirals—Anson, Collingwood, Camperdown, Howe, Rodney, and Benbow. They are all barbette ships, the guns being mounted inside a fixed circular breastwork of thick armor plating, wherein the gun revolves on a turntable, and fires over the breastwork. The barbettes are placed one at each end of the superstructure, or midship battery, and the guns have each a clear range of 230 deg., viz., from 25 deg. abaft the beam to all round the bow or stern to 25 deg. on the opposite side, and converging upon an object on the broadside at about fifty yards.

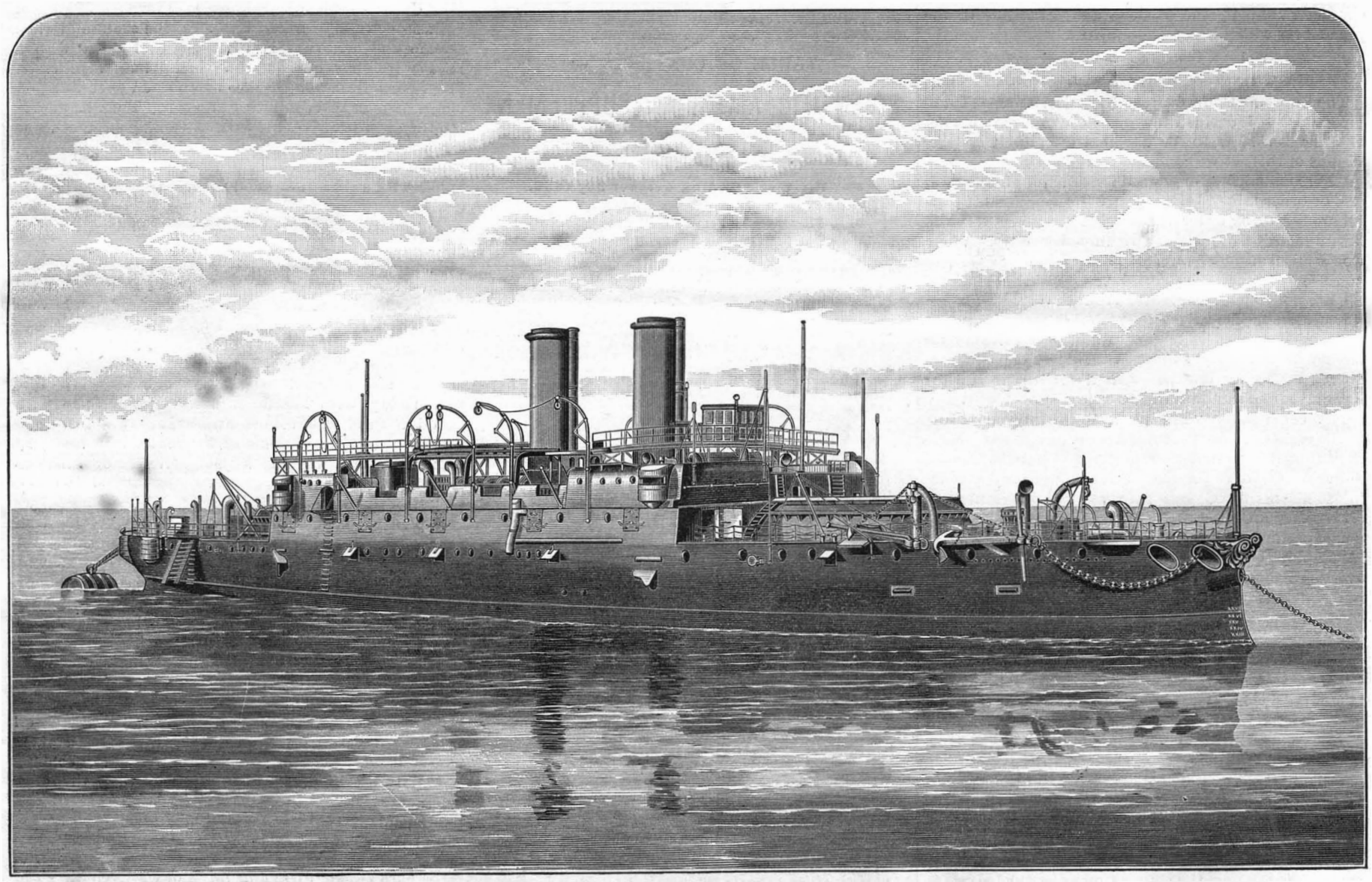
The Benbow has been chosen as one of the six vessels of this class to mount two guns of 110 tons each, one being mounted in each barbette; whereas, in the other five vessels, two guns are carried in each barbette, but of 63 tons only instead of 110 tons. These terrible engines of warfare would be most destructive in action, and are, in fact, formidable weapons, but in some quarters such enormously large guns are not viewed with much favor. England, in the matter of adoption of such heavy guns, has been following in the wake of Italy.

In addition to the two 110 ton guns, the Benbow carries a battery of ten 6 in. guns, twelve rapid-firing guns, and fourteen machine guns, these latter very conveniently arranged for use against torpedo boats. She is also fitted with four torpedo ports on the broadside and one through the upper part of the stern, all above water. The Benbow was launched on June 15, 1885, and has since that date been lying near the works for the purpose of receiving her machinery and boilers, and for the completion of the multitudinous fittings of a modern ship of war. It would be impossible to describe on paper the character of such fittings, including the pumping, draining, and ventilating, some 180 separate compartments, each compartment being fitted with an automatic valve, where the ventilating pipe or trunk passes through, so that in the event of the water entering any one compartment, and rising to the height of the trunk—the trunk being assumed to be possibly damaged—the water would close the valve, and so be confined to the damaged compartment.

Some idea of the complication of the gearing in a modern war vessel as fitted in England may be obtained when we state that no less than 83 water-tight doors and armor deck shutters are fitted in this vessel, in addition to 85 water-tight doors that open and close by hand without gear. The deck plates, to which indicators are fitted, showing when each door or valve is open or closed, amount to no less than 250, in addition to the two automatic valves above named. Then, including the main engines, fan engines, pumping engines, electric light engines, steam steering and capstan engines, there are no less than forty separate sets, all to be kept in proper going order, requiring all the care Mr. White, the chief engineer, and his able staff are able to bestow upon them. Mr. Yates, of the Royal Naval Corps of Constructors, has had the inspection of the Benbow, aided by a staff of assistants, to see that the company fulfills its contract; and any one comparing the Benbow with any of the sister ships will see that the full "pound of flesh" has been demanded and readily given, the Thames Company, ever since it built the Warrior in 1861, having maintained its reputation as builders of first-class naval constructions, and to this day retains its oldest connections in almost every nation.

The dimensions of the Benbow are as follows: Length, 330 ft.; breadth, 68½ ft.; and depth, 37 ft. The engines, supplied by the well-known firm, Messrs. Maudslay, Son & Field, are of the three-cylinder compound type, of 7,500 indicated horse power, and reaching 9,000 with forced draught, giving an estimated speed of 16 knots. The Benbow, like other ships of this class, is of the citadel type; this means that the vital portion of the vessel for about half of her length is protected by being included in an iron box armored with 18 in. plates on the side, the top of which at full draught is 2½ ft. above and 5 ft. below water, giving a total depth of 7½ ft. The athwartship bulkheads forming the two ends of the citadel are 16 in. thick; before and abaft these there is an armor deck of 3 in. steel plating. Except for this steel deck, which is calculated to shield all below it from the fire of very heavy guns, the ends of the vessel are unprotected, and in a heavy engagement the superstructure would suffer severely. In the case of other types of war vessels, protection is afforded by a belt of armor plating all fore and aft, being thickest amidships and tapering toward the ends. But it is evident that all that could be done on the dimensions and displacement of the Benbow has been done; for in order to provide for the armor deck and additional freeboard of the Nile and Trafalgar, the displacement tonnage has had to be increased by 2,000 tons, making them 12,000 tons displacement instead of 10,000, as in the Benbow.

Recently, in the presence of Mr. Joshua Field and Mr. Hayward, the manager of the Thames Iron Works, the steam was for the first time admitted into the huge cylinders, when immediately the engines in both engine rooms started almost simultaneously, and continued steaming for three hours, thus showing that all was in perfect order and the vessel capable of making her short cruise to Chatham. The Sans Pareil, a sister vessel to the Renown, building at Newcastle, a vessel



10,000 tons displacement; 9,000 H. P.; speed, 18½ miles per hour; two 110 ton guns, ten 6 in. guns; four torpedo ports.

H. M. BARBETTE IRONCLAD SHIP BENBOW.

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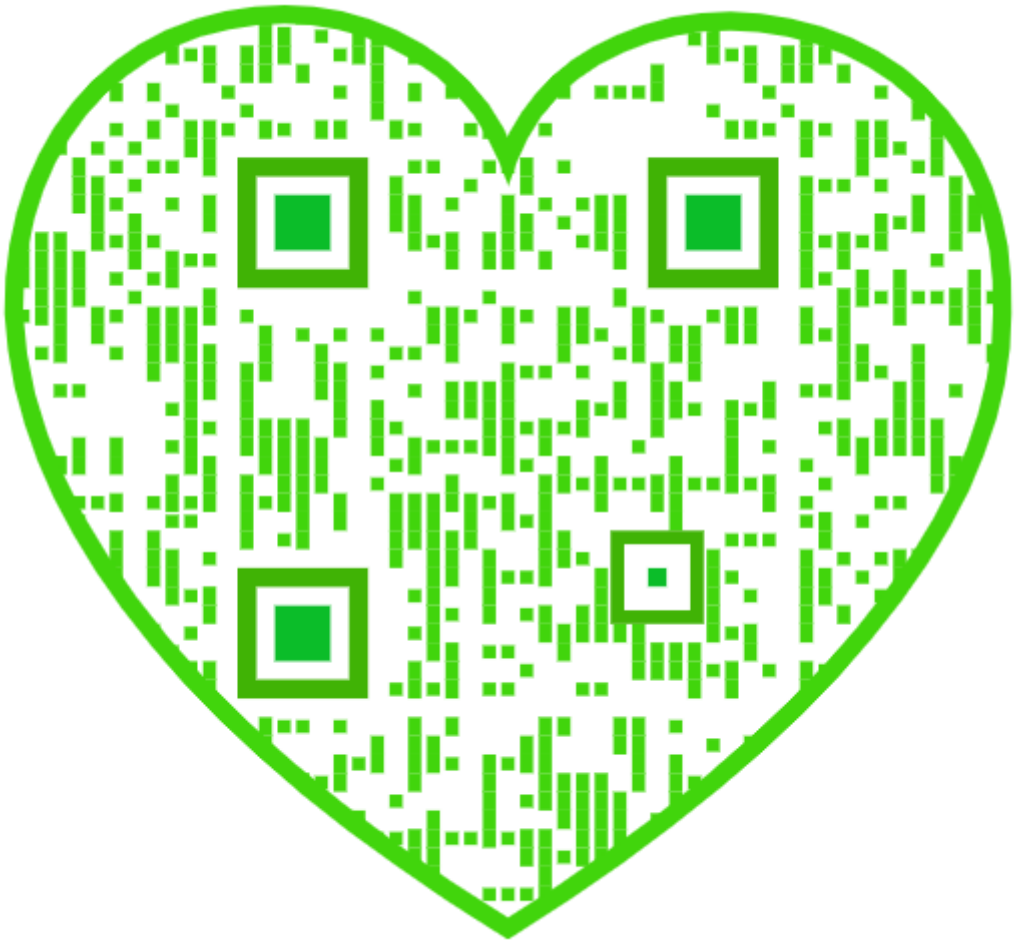

of somewhat similar dimensions to the Benbow, is making rapid progress at these works, and is to be launched in the spring of next year; some 3,000 tons of material being already worked into place on the slip previously occupied by the Benbow, sixteen of the massive armor plates already in place weighing twenty tons each. The huge wrought iron sternpost for the new Italian armorclad Re Umberto is being forged and machined at these works also, which, considering the dearth of work everywhere, appear to be fairly busy. —*The Engineer.*

James G. Wakley, M.D.

Dr. James Goodchild Wakley, for the last twenty-five years editor of the *Lancet*, died at his residence, Heathlands Park, Longcross, England, on the 30th of August.

Dr. Wakley was born in Thistle Grove, Brompton, in December, 1825, and was the youngest son of Thomas Wakley, M.P., the founder of the *Lancet*. He was educated at a private school at Hanwell and at University College School, London. His professional training was obtained at University College. He was graduated as doctor of medicine at King's College, Aberdeen, in 1852. He never engaged in medical practice, but, when about thirty years of age, began under his father's guidance a journalistic career. He was soon intrusted with a large share of editorial responsibility, and about the year 1859 became actual, though not nominal, editor of the *Lancet*. It was not till his father's death, in 1862, that he took this designation, becoming at the same time half proprietor of the journal with his eldest brother.

The editorial life of Dr. Wakley was one of peculiar devotion to his work. He not only maintained, but extended, the reputation that the *Lancet* had acquired under its founder's direction for earnestness of purpose, strict integrity, and unselfish zeal for the public good and for the welfare of the best and permanent interests of the medical profession.

He was essentially a journalist, and to make the *Lancet* effective he spared no pains, night or day, summer or winter. His first care was to make his journal the exponent of the views of medical men in every part of the kingdom and of the empire; and so long as such views came out of honest observation and practical experience, they commended themselves to Dr. Wakley, and found a place in the *Lancet*, notwithstanding they might not always be perfect in form or demonstration.

Dr. Wakley made no pretensions to great learning or a deep acquaintance with science, but he had an ample store of common sense, and a faculty of very quickly and surely gauging professional opinion. He was singularly free from personal or malicious feeling, though strongly tempted thereto occasionally in the conflict raised by the reviews and criticisms of the journal for which he was responsible.

The Store Order Act Invalid.

The Supreme Court of Pennsylvania, sitting at Pittsburg, on Oct. 4, decided the anti-store order system act of June 29, 1881, to be unconstitutional. The provisions of this act we condense as follows:

"Persons mining or manufacturing, or either, coal, ore, or other mineral shall pay their employes in lawful money, or by order redeemable at its face value in lawful money by the issuer within thirty days. Violation a misdemeanor, punishable by fine up to $100, to go to school fund. Employes interested in merchandising are not to make a greater profit on goods than outside dealers in like articles. Violation makes the debt uncollectible from employe. Employers refusing for twenty days to pay employes regularly or to redeem orders shall pay one per cent a month, if suit be brought for the amount due."

The court said: "The act is an infringement alike of the rights of the employer and the employe. More than this, it is an insulting attempt to put the laborer under a legislative tutelage which is not only degrading to his manhood, but subversive of his rights as a citizen of the United States. He may sell his labor for what he thinks best, whether money or goods, just as his employer may sell his iron or coal, and any and every law that proposes to prevent him from so doing is an infringement of his constitutional privileges, and consequently vicious and void."

American Gaslight Association.

This association held its fourteenth annual meeting in Philadelphia, October 20 and 21. It was called to order by its president, A. C. Wood, of Syracuse. A paper, followed by a long discussion of State gas commissions, filled the first day, the conclusions being favorable to the creation of these bodies. Various papers on technical points were given. The second day opened with a paper on natural gas, which was read by W. H. Denniston, of Pittsburg, Pa. In that city alone 38,000,000 cubic feet are consumed daily. After the reading of other papers the convention adjourned *sine die*. A banquet was partaken of in the evening by the members.

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NEW YORK, SATURDAY, OCTOBER 30, 1886.

Contents.

(Illustrated articles are marked with an asterisk.)

Aquatic arena at Paris*..... 280
Barff, Professor..... 273
Barrel cover, Hodsden's*..... 274
Barytes in white lead, detecting. 273
Bridge, double parabolic, for Harlem River*..... 278
Business and personal..... 282
Capillary vacua*..... 281
Cars, construction, for track laying*..... 274
Centerboard, swinging, for vessels*..... 275
Cliff of glass, a..... 278
Clubs, Indian, home-made..... 277
Compass, why it went wrong..... 277
Cotton planter, Lowry's*..... 274
Dark room, yellow light for..... 275
Doctors and naturalists, German 273
Earthquake, recent, the..... 277
Earthquakes..... 277
Egg beater, Vicker's*..... 274
Explosion, boiler, at Charlotte, N. C.*..... 279
Fear in animals..... 274
Gaslight Association, Amercian.. 272
Gun, English, the new..... 279
Heating water rapidly*..... 279
Hospital, cholera, at Rome, model..... 276
Inventions, agricultural..... 282
Inventions, engineering..... 282
Inventions, index of..... 283
Inventions, miscellaneous..... 282
Inventors, rewards to, by the British Government..... 274
Ironclad ship Benbow, barbette* 271
Jaw, human, not evolved..... 273
Jute goods industry, the..... 281
Lawsuits, avoid..... 280
Mercury column sustained by vacuum*..... 281
Mine drainage..... 276
Mushrooms on shelves*..... 275
Notes and queries..... 283
Pilgrim ship Mayflower, the..... 279
Poisoning, ivy, itching, to relieve..... 273
Quarry accident, remarkable..... 279
Railway speed, remarkable..... 273
Saccharine..... 280
Sawdust for cleaning garments.. 275
Sea, great rise of, at Sabine Pass 277
Statue of Liberty finished, the... 272
Steamer, ocean, hold of, in the.. 272
Store order act invalid, the..... 272
Sugar as an anti-incrustator in steam boilers..... 280
Sword, electric..... 274
Thermo-electric materials, new.. 273
Torpedo, Brennan, the..... 280
Tower, French, proposed, the.... 278
Vessels over obstructions, carrying, apparatus for*..... 275
Wakley, James G., M. D. 272
Washing machine, Kramer's*.... 274
Water mains, leaks in, detection of..... 276
Waterworks, system of, unique.. 276
Weight sustained by vacuum*... 281
Wells, petroleum, Egyptian*.... 279
Wires, underground and other, insulating, simple method of* 275

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 565.

For the Week Ending October 30, 1886.

Price 10 cents. For sale by all newsdealers.

PAGE

I. AGRICULTURE.—Improved Ensilage Press.—Detailed description of a new press by which ensilage can be produced without a pit or silo.—5 illustrations..... 9029
The Value of Ensilage.—A practical judgment on its great value to the farmer..... 9030

II. BIOGRAPHY.—Carl Wilhelm Scheele.—A biography of the greatest of chemical discoverers; his work in chemistry, his life, and list of his published papers.—6 illustrations..... 9024

III. BIOLOGY.—The Directions of Development the True Indications of Character.—By J. W. REDFIELD, M.D.—A discussion of the development of facial characteristics in man and animals..... 9023

IV. BOTANY.—The Clammy Columbine.—1 illustration..... 9030

V. CHEMISTRY.—On the Connection between Chemical Constitution and Physiological Action.—By THOMAS LAUDER BRUNTON, M.D.—An elaborate paper on the relations of chemistry and physiology; an objective treatment of the subject of medication..... 9027
Outlines of a New Atomic Theory.—By Dr. I. L. PHIPSON, F.C.S.—An attempt to introduce a new factor into chemistry, interatomic distance or phlogiston..... 9025

VI. ENGINEERING.—Express Engine, Great Western Railway.—Full dimensions, partialsection, and elevation of a new type of locomotive engine, with inside cylinders and external eccentrics.—2 illustrations..... 9015
Making a Street Cable.—Full description of the manufacture of a cable for a cable railroad..... 9017
Pulverizing Machines.—By Prof. VON HERMANN FISCHER.—A full treatment of this subject, as regards the crushing of grain and stone breaking.—35 illustrations..... 9015

VII. GEOLOGY.—The Geology of the Atlantic.—By Prof. J. WILLIAM DAWSON.—An exhaustive review of this subject.—The president's address at the 56th annual meeting of the British Association for the Advancement of Science..... 9020

VIII. MINING AND METALLURGY.—Production of Nickel.—The New Caledonia deposits.—Their mineralogical characteristics and commercial importance..... 9026
Speed of Mining Cages..... 9015
The Bloomery.—American applications of the Catalan forge.—1 illustration..... 9027

IX. MISCELLANEOUS.—Causes of Conflagrations..... 9027

X. NAVAL ENGINEERING.—New Channel Steamer Victoria.—The last and fastest accession to the Channel fleet.—The quickest passage on record from Calais to Dover.—1 illustration..... 9018
Steel Stern Wheel Steamer.—Full description of a new light draught steamer for African river travel..... 9018

XI. PHYSICS.—A Mercurial Air Pump.—By J. T. BOTTOMLEY.—A new pump for obtaining high vacua, in which the mercury is protected from the air.—1 illustration..... 9019
A New Thermopile.—Description and discussion on Prof. Geo. Forbes' new instrument.—1 illustration..... 9026
Propagation of Light.—By J. H. POYNTING, M.A., and E. F. J. LOVE, B.A.—New experimental demonstration of some of the laws of light.—1 illustration..... 9026

XII. TECHNOLOGY.—Improved Doubling Winding Frame.—An automatic stopping machine, with extraordinarily quick acting arrest.—1 illustration..... 9019
Improved Method of Spindle Driving.—A driving arrangement with gravity take-up for the belt, of extremely simple and efficient construction.—1 illustration..... 9019
Kapok: A New Fiber.—A new product of the East Indies and India.—Its peculiarities, value of exports for different years, and its botanical identification..... 9018

THE STATUE OF LIBERTY FINISHED.

As we go to press, the final preparations are being made for publicly dedicating the grandest statue the world has yet seen. The cheerful gift of the people of one great nation to those of another, and yet resulting from the united effort of both, it symbolizes the deep, friendly feeling which, for more than a century, has existed between the two. On the 28th inst., eminent citizens of the French Republic will meet on Bedloe's Island the President and most honored citizens of the United States, and together they will perform the ceremonies celebrating the completion of the Statue of Liberty. The work as now seen leaves no room for criticism—the statue itself is grand, imposing, and dignified; while the pedestal is rich and ornate, yet so quiet as to enhance, rather than detract from, the beautiful features of the figure it upholds. The hope of all is that the principle here typified and the frendship of the two peoples may continue for all time.

In the Hold of an Ocean Steamer.

"How long do stokers live?" asked a *Tribune* reporter of an engineer of one of the swiftest ocean racers that ply between this country and England.

"As long as anybody," was the unexpected reply.

"How do they like their work?"

"If they don't like their work, they get out; there are plenty willing to take their places," was the answer. But it is hard to persuade the average landsman that the stoker's life is not shortened by constant exposure to the extremes of temperature. Transatlantic passengers who have braved the intense heat of the furnaces and visited the fire room wonder how men can endure such a life even for a voyage. The stokers work four hours at a stretch, hemmed in between two long lines of furnaces that keep the temperature ordinarily at 120 degrees, sometimes sending it as high as 160. The space between the furnaces is so narrow that when the men throw in coal they must take care when they swing back their shovels, lest they should burn their arms on the furnaces behind them. The only means of ventilation is one large air pipe that reaches down into the center of the stokers' quarters, and on a big steamer the men have to take the air in batches. On a great ocean steamer like the Umbria, the men come on in gangs of eighteen stokers and twelve coal passers, and the "watch" lasts four hours. The Umbria has 72 furnaces, which require nearly 350 tons of coal a day, at a cost of almost $20,000 per voyage. One hundred and four men are employed to man the furnaces, and they have enough to do. They include the chief engineer, his three assistants, and ninety stokers and coal passers.

The stoker comes on to work wearing only a thin undershirt, light trousers, and wooden shoes. On the Umbria each stoker tends four furnaces. He first rakes open the furnaces, tosses in the coal, and then cleans the fire, that is, pries the coal apart with a heavy iron bar, in order that the fire may burn freely. He rushes from one furnace to another, spending perhaps two or three minutes at each. Then he dashes to the air pipe, takes his turn at cooling off, and waits for another call to his furnace, which comes speedily. When the "watch" is over, the men shuffle off, dripping with sweat from head to foot, through long, cold galleries to the forecastle, where they turn in for eight hours. Four hours of scorching and eight hours' sleep make up the routine of a stoker's life on a voyage.

The reporter ran across a group of stokers in West Street, and had a chat with one of them. "I went to sea as a coal passer when I was fourteen years old," he said. "Then I got to be a stoker, and I am now twenty-eight." The speaker was about six feet in height, and weighed 180 pounds or more. His face was ruddy with health, and his eyes beamed with good nature. His robust appearance was in strong contrast to that of some of his mates who had just landed from a voyage, a pale, streaked out, listless-looking set of men.

"How do we stand the work? Well enough if we get plenty to eat. But the work is terribly hard all the same. It comes hardest, of course, on those who don't follow it regularly. They are the fellows who get played out so badly. I heard once of a young English doctor who came over here on a visit. He got out of money, and was that proud that he wouldn't send home for some. So he worked his way back as a stoker, and got a sickness that he could never get rid of. But if we get plenty to eat, and take care of ourselves, we are all right. Here's a mate of mine nearly seventy years old, who has been a stoker all his life, and can do as good work as I can. Stokers never have the consumption, and rarely catch cold."

"Why do you appear more healthy than the other men here?" asked the reporter.

"Well, I have been on land now about two weeks, and these men just came off the ship. You see, when we finish our watch at the furnaces, we are just covered with sweat, dirt, and oil, and we have to wash the stuff off with warm water. Washing so much with warm water gives us that streaked out look

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that makes people think we are being killed with consumption. But after we have been on land three or four days that look disappears, and the men look natural again. We get more ventilation than the old timers used to get, but we don't have any too much. I tell you, when I used to go down into the tropics, I wanted to keep under the air pipe all I could. Now I go to England and back, and have four furnaces to tend. Four hours is just about as much as we can stand before the fires. It uses some of the men up so badly that when the watch is over they can just crawl to the forecastle, and throw themselves on their bunks without washing a bit. But others of us don't mind it so much. We heat our water, take a wash, and then have a pipe or two before turning in."

"What do we eat and drink?"

"We have hash, all the oatmeal we want, coffee, and other good things."

"How about the grog?"

"Well, the fact is that the grog was knocked off about eight years ago on the English and American lines. The truth is the men got drunk too much, and grog did them much harm. When I used to take my grog, I'd work just like a lion while the effects lasted. I'd throw in coal like a giant, and not mind the heat a bit; but when it worked off, as it did in a very few minutes, I was that weak that a child could upset me. Take a man dead drunk before the fires, and the heat would sober him off in half an hour or give him a stroke of apoplexy. The French lines still give their men grog. I have seen big tanks on their ships filled with brandy, rum, and wine, all for the stokers. The French are great fellows for that. Their men look strong, but I think it must hurt them. We get grog occasionally now when we are having a race, and then we 'play it.' I remember one race we had about a year ago with a Dominion mail steamer. She got ahead, and our captain was mighty anxious to beat her. So he sent down grog to us, and told us to fire up like mad. Well, we did until we learned that we were ahead. Then we took a rest. Down comes the captain with another lot of grog. 'Fire her up, boys,' yells he, and we did fire her up like lions, until we were ahead again. We kept that up for three days, and got all the grog we wanted. But finally we let her beat us, as the grog played us out too much. But we don't often have such fun as that," the stoker added, as he strolled aboard ship.

German Doctors and Naturalists.

The fifty-ninth meeting of the Society of German Naturalists and Physicians has recently been held at Berlin. Its field of work is very large, the meeting this year having been divided into thirty sections, of which twenty-one were more or less medical, and some of the sections had as many as 400 members. Professor Virchow gave the introductory address, in which he alluded to the scientific activity of the German race as a guarantee for the growth of the German nation. He spoke of the connection of the natural sciences with medicine, and of the new method, the mechanical method, of research, which, by replacing so called natural and speculative philosophy, remodeled the whole of biology and gave the basis to all scientific inquiry. Darwin tried to solve the question of descent, not in the sense of the old natural philosophy; he did not discuss general probabilities, but looked for the several practical cases; he did not search for special organic powers, but tried to find the mechauical effect of natural causes. The same method has been pursued ever since; and if in recent years rapid advances have been made, especially in the study of infectious diseases, the aim and the method have remained the same—the scope only of our investigations has been altered. "Our modern transactions are characterized by the spirit of empirical but methodical investigation, the spirit of practical synthesis, the spirit of brotherly co-operation in the several branches of the wide scientific field."

Dr. W. Siemens gave an able address on our scientific age, and was followed by Professor Bardeleben, of Jena, with a paper on "Hand and Foot," in which he compared the hand with the foot on the basis of comparative anatomical and palæontological data. Professor Cohn (Breslau) read a paper on "Questions of Life" (*Lebens fragen*), which showed that the great problem is not yet solved, and that in the living organism there are forces which, though they must be mechanical, as they put bodies in motion, yet cannot be split up into components of atomic molecular forces. "The gulf which separates life from death, organic from inorganic bodies, is not closed, and none of our hypotheses will help us to bridge this gulf." He was followed by Dr. Schweinfurth with a paper on a geographical subject, and by Professor His on the "Development of the Zoological Station at Naples and the Growing Necessity for Scientific Central Stations." Professor Stricker (Vienna) gave a demonstration with his powerful electric microscope, and showed how useful the instrument is for lecture purposes. Professor Bergmann, of Berlin, spoke of the relations of modern surgery to internal medicine, the triumph of surgery due to the antiseptic method of Lister, and the scientific development of surgery. Wounds can now be made to heal so readily that surgery has invaded the territory of medicine, and serious operations on internal organs are performed, and often, also, operations merely for the purpose of diagnosis. Internal medicine, occupying itself largely with those disease germs which are brought to the organism from without, tries to wage war against these germs in their native elements—the air, water, and soil—and is becoming more and more preventive.

Professor Barff.

Frederick Settle Barff, M.A., died at Buckingham, on August 11, in the sixty-third year of his age. Mr. Barff delivered before the Society of Arts, in 1870, a series of Cantor lectures on "Artistic Colors and Pigments." As this time he held the office of Assistant Professor of Chemistry at University College, London. It was owing to the attention drawn to the subject of these lectures that the chair of chemistry was founded at the Royal Academy, and that Mr. Barff was appointed the first professor. Professor Barff delivered a course of Cantor lectures in 1872, on "Silicates, Silicides, Glass, and Glass Painting;" and another, in 1874, on "Carbon and Certain Compounds of Carbon, treated principally in Reference to Heating and Illuminating Purposes." He also gave the Juvenile lectures for 1878, on "Coal and its Compounds." For his paper on "Zinc White as Paint, and the Treatment of Iron for the Prevention of Corrosion," read in 1877, Mr. Barff received the Society's medal. In this paper he announced the discovery of his method of protecting iron from rust by producing a film of magnetic or black oxide of iron on the surface of the metal. In March, 1879, he read a second paper on his process for "The Treatment of Iron to Prevent Corrosion." In 1882, he obtained another medal for a paper on a "New Antiseptic Compound and its Application to the Preservation of Food." Mr. Barff served as examiner in chemistry for the Natural Science Tripos at Cambridge, and held the office of Professor of Chemistry to the Catholic University at Kensington and in the Jesuits' College, Beaumont. He was elected a member of the Society of Arts in 1870.—*Journal Society of Arts.*

Remarkable Railway Speed.

The following is the time made by newspaper special train No. 11 on the New York Central & Hudson River Railroad between Syracuse and Buffalo, on August 8, 1886. The train was drawn by engine No. 541, John W. Cool engineer.

Stations.	Departure.	Distance. Total.	Distance. Intermediate.	Time between Stations.	Rate of Sp'd per hour.
	H. M. S.	Miles and Hun'ths.	Miles and Hun'ths.	Minutes and Sec.	Miles & Hun'ths
Syracuse	10 A. M.				
Oswego Junction	10 03 30	3	3	3 30	54 54
Warner's	10 09 30	9 34	6 34	6	63 40
Jordan	10 16 30	17 05	7 71	7	66 08
Weedsport	10 20 20	21 39	4 34	3 50	74 40
Port Byron	10 23 20	24 76	3 37	3	67 40
Savannah	10 29 35	31 76	7	6 15	68 29
Clyde	10 35	37 96	6 20	5 25	70 85
Lyons	10 41 50	45 33	7 37	6 50	68 03
Palmyra	10 52 35	57 84	12 51	10 45	70 62
Fairport	11 03	70 64	12 80	10 25	74 93
Rochester	11 12	80 73	10 09	9	67 27
Rochester*	11 20				
Coldwater	11 25 35	86 89	6 16	5 35	69 08
Bergen	11 35 15	98 44	11 55	9 40	73 72
Byron	11 41 10	106 16	7 72	6 55	70 72
Batavia†	11 50	112 75	6 59	7 50	52 72
Crittenden	12 03 30	128 52	15 77	13 30	71 14
Grimesville	12 12	138 11	9 59	8 30	69 33
Buffalo E. St	12 24	148 70	10 59	12	52 95

* Stopped for water. † Slowed up.

Average speed Syracuse to Rochester ..... per hour 67 27
" " Rochester to Buffalo ..... " 63 72
" " Syracuse to Buffalo ..... " 65 60

The train consisted of a baggage car and coach. The engine had 17×24 in. cylinders; wheels, 5 ft. 6 in. diameter; fire box, 72 in. long. The boiler had 1,353 sq. ft. of heating surface. The valves had a maximum travel of 5 in., ⅞ in. outside lap and $\frac{1}{32}$ in. inside. The steam ports were 15½ in. ×1⅛ in.

The Human Jaw not Evolved.

Dr. W. G. A. Bonwill, of Philadelphia, believes he has only to demonstrate that life has not been evolved by means of "infinite variations," and he has proved the theory of evolution to be false. In other words, he needs only to find an arch type, and this is exactly the nature of the Doctor's claim. It has been thought impossible so to fathom the mysteries of a single human organ as to arrive at such a definite conclusion. It may seem unwise to disclose a discovery like this, but it will set some jaws wagging to learn that the Doctor's *dixit* is simply this, in a nutshell:

That from the center of motion of each condyloid process of the lower jaw to the symphysis, or where the lower central incisors meet at their cutting edges, is an equilateral triangle, and has always existed in the human being. The measurement of 3,000 skulls and observation of phenomena presenting the same for twenty-eight years attest it. Given, then, the point of the problem and the shape of any first superior bicuspid, and we have a geometrical figure that mechanical law alone can fathom, There can be but one form of jaw and teeth, and that the arch type. Any change from this is retrograde, and not "progress."

He has made a machine which develops to perfection these laws, and it artificially performs the divine process, which could be done in but one way, and is unalterably perfect, save to become less perfect from environment, and is in no way at all approached by any other animal. Here then, briefly, is something for the scientist, and evolutionist in particular, to put in his pipe and smoke.—*Phil. Press.*

New Thermo-Electric Materials.

M. G. Chaperon, a French physicist, has made a set of researches on the thermo-electric properties of a number of substances which promise to become useful as new materials for the construction of thermo-electric generators. The method consists in taking a small fragment of the substance and bringing one end into contact with a source of heat in the shape of an iron crucible containing some fused alloy, a thin layer of silver being interposed if the substance attacks the alloy, while the other end of the substance is cooled by water circulating in a small silver tube. A thermometer in the alloy gives the temperature of the heated junction. In cases of higher temperature, a bar of copper kept hot takes the place of the crucible. The electromotive force is that of the substance and the couple formed by the substance and the silver; and it is measured by the Lippmann electrometer and a potentiometer giving $\frac{1}{500}$ volt values. The following results have been obtained:

Positive Bodies.	Electromotive Forces. Temperature. From 20 deg. to 12 deg. C. Volts.	From 20 deg. to 400 deg. C. Volts.
Iodide of silver	0·115	0·192
Phosphide of zinc	0·107	0·362
Sulphide of tin	0·052	0·227
Crystallized galena	0·034	
Oxide of cop., thin plates	0·03	
Arsenide of zinc	0.014	
Antimonide of zinc	0·018	
Sulphide of silver	0·091	0·108
Specular iron	0·063	0·25
Crystallized galena (another specimen)	0·029	

Other substances, such as sulphide of antimony, iodide of lead, oxide of tin, crystallized silicium, etc., give thermo-electric results. The curves representing the electromotive force in terms of fall of temperature show in general a uniform progress from a certain point. For sulphide of silver and iodide of silver, the law, however, of variation suddenly changes, and does not appear to be representable by a continuous function. The sulphide of silver exhibits the property of reduction to the metallic state locally in a great number of circumstances, when it is traversed by a flow of heat between two conducting surfaces. This effect is easily produced by placing a plate of sulphide between a heated plate of silver and a cooled tube of silver. The whole being isolated, there forms itself in a few moments a deposit of silver on certain points of the cold contact. This deposit argues a current going from the sulphide to the cold silver.

Detecting Barytes in White Lead.

The most common attendant of white lead is permanent white, or sulphate of baryta. This admixture may be recognized by boiling a small quantity of the pigment in a glass test tube or flask, with nitric acid diluted with an equal measure of water. The white lead dissolves, but any sulphate of baryta remains as a white residue. To prevent any chance of error, the residue should be allowed to settle, the clear liquid poured off, and the deposit again treated with nitric acid and then boiled with water.—*London Coach Builder.*

To Relieve the Itching in Ivy Poisoning.

Dr. J. W. Little, of Washington, D. C., writes to the *Medical Record*: "Having tried everything I could think of for the intense itching caused by poison ivy, I was at a great loss to know what to do for a patient who was becoming dissatisfied. I concluded to try the following original prescription: Bromo-chloralum, ʒ iv; vinum opii, ʒ ij; aquæ, ʒ vj. My patient was ordered to bathe the parts freely with this, and informed me that it 'acted like magic,' and relieved the itching at once. I have tried the same in other cases, and also in urticaria, with relief."

AN intelligent physician says: "It is a good rule always to ride up in an elevator, and when coming down to take the stairs. Like going up hill, walking up stairs is hard work, and sometimes risky, especially for people with weak lungs, defective respiratory organs, or heart disease. But going down stairs hurts nobody, but is good exercise; going down on a brisk run is really a good thing—it shakes up the anatomy, without incurring the danger of physical overexertion. This shaking up is good for one's internal mechanism, which it accelerates, especially the liver, the kidneys, and the blood circulation."

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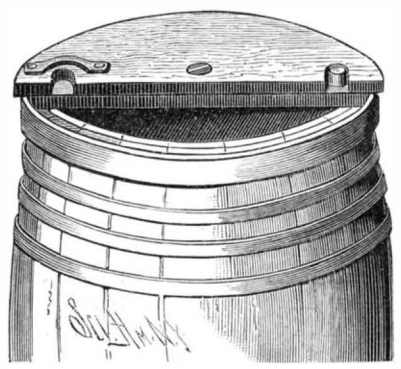
BARREL COVER.

The barrel cover herewith illustrated is the invention of Mr. W. Wirt Hodsden, of Smithfield, Va. The stationary part of the cover is formed with a straight edge extending beyond the center of the barrel cover. To this board is secured a wide hoop adapted to receive the end of the barrel. Pivoted to this part is the movable cover. Projecting from the upper surface of the stationary part near its straight edge is a pin, and in the movable part are formed two notches at opposite sides of the pivot, which receive the stop pin. By grasping the handle secured to the movable part, the cover may be opened more or less as required. The two notches limit the movement of the cover, so that



HODSDEN'S BARREL COVER.

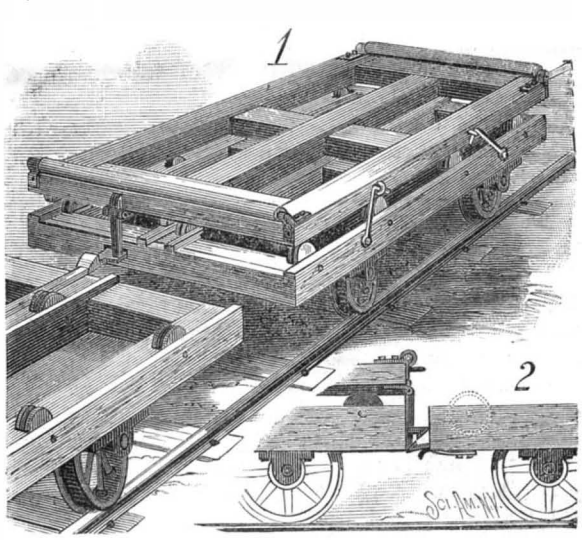
the straight edges of the two parts will be parallel both when the cover is open and when it is closed.

An Electric Sword.

According to the *Electrical Review*, an inventor at Shanghai, China, has contrived an electric sword, which, when the point touches the party attacked, sends a powerful shock through him, and if not immediately killing, will at least put him *hors de combat*. The sword is an ordinary military saber; but along its whole length is let in a fine platinum wire, which ends at the point of the weapon. A small but very powerful storage battery is carried strapped about the waist, much the same as a cartridge box. Insulated wires connect this battery with the sword, and by pressing the button, the holder can complete the circuit at pleasure.

CONSTRUCTION CARS FOR TRACK LAYING.

This form of car—the invention of Mr. E. N. Emmons, of Washington, Kansas—is designed more especially for use as a construction car, that is, a car employed for transporting small quantities of iron, ties, and other supplies used in the building of railroads. One of two similar cars is left close by the large car from which the supplies are taken, while the other is employed to carry the material to the front. Each car is provided with grooved rollers, upon which ride rails fixed to the under side of auxiliary platforms, formed with openings so located that when the platform is in position upon a car, the openings will be directly over box-like pockets of the platform. At each end of the platform is a roller that provides for the easy loading or unloading of rails. Each car is provided with coupling hooks, as shown in Fig. 2. The platforms are held to the cars by hooks. The cars, being exactly alike, may be used interchangeably with two or more platforms. After the car has been brought in from the front, the unloaded platform is lifted from



EMMONS' CONSTRUCTION CARS FOR TRACK LAYING.

it by hand, when the loaded platform carried by the stationary car is moved forward on to the unloaded car, this movement being accomplished by means of a horse hitched to an eye so placed that he can travel upon the right of the track. As the loaded platform reaches its proper position, it uncouples the coupling between the two cars, and thereby releases them. It will be understood that the rear car can be moved forward, and the transfer made at the point where the track is being laid.

Fear in Animals.

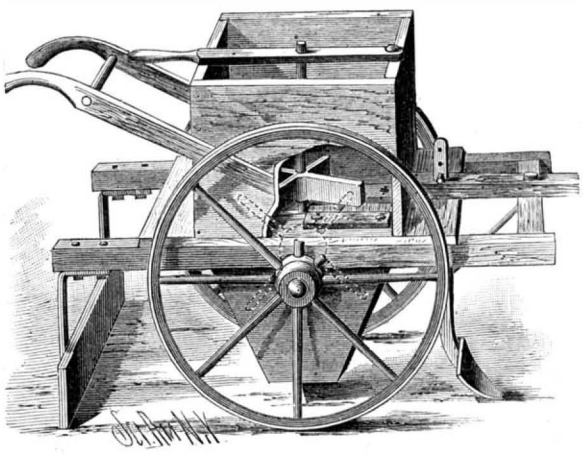
Probably, ever since the second man came into the world, the question of reason or instinct in animals has been debated, and until animals are endowed with the organ of speech, it will continue a debatable question with many. At the present time, we have two pets—a bird and a dog—that come as near to reasoning beings as any animals we ever knew; and yet, through the organ of fear, they both show an entire lack of reason. The bird, a "*rose-breasted grosbeak*," in its ninth year, which shows no ordinary fear of anything; for, on one occasion, we brought home a tiger cat, that, on seeing the bird, made a wild bound for it, and yet the bird merely threw its wings wide open, and, opening its mouth, placed itself in an attitude of defense. At the same time, when a pair of oxen pass the house fifty feet away, with the blinds closed and slats open, the bird loses all control of itself with fright.

The dog is a Scotch terrier, with courage enough to tackle the biggest dog that comes into the yard; and yet, on one occasion, in the evening, coming home late, I distorted myself and made a queer noise. The dog barked, retreating around the house, and I after him, making a great noise. He jumped down off the piazza and down a very high bank wall, and left the house, apparently forever. As he did not return, I went in search of him, an hour later, and found him wandering aimlessly about, and it was with difficulty I could persuade him to return. It is fair to state, however, that Teddy had hardly arrived at the age of maturity.

JOS. M. WADE.

COTTON PLANTER.

The engraving represents a machine of simple construction for planting cotton uniformly. To the middle part of the frame is attached a hopper having a slotted bottom for the passage of radial fingers fixed to the axle. The rear part of the slot is only wide enough for the passage of the fingers, while the forward part is widened to allow the fingers to carry the seed with them as they pass out through the slot. The width of this forward part of the slot is regulated by



LOWRY'S COTTON PLANTER.

plates, which can be readily adjusted wider apart or closer together, according as more or less seed is to be planted. In the hopper is a vertically mounted shaft, provided at its lower end with radial arms made wide enough to push the seed over the forward part of the slot, so that it will be pushed through by the fingers. These arms are struck and revolved by the radial fingers as the machine is drawn forward. A tapered spout on the lower side of the middle part of the frame guides the seed into a channel opened by a plow so arranged that it may be adjusted to enter the ground to any desired depth. The seed is covered and the top of the ridge is smoothed off by a board attached to spring hangers secured to the rear ends of the side bars of the frame.

This invention has been patented by Mr. T. P. Lowry, of Bryan, Texas.

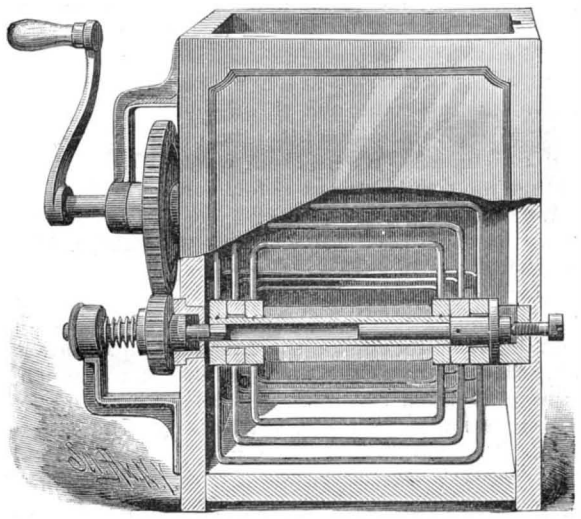
Rewards to Inventors by the British Government.

The sums paid to inventors, in connection with ordnance and small arms, between the years 1878 and 1886 range from £10,000, paid to Mr. Nordenfelt for manufacture in government factories of ammunition for 1 inch Nordenfelt guns, a similar sum to Mr. Vavasseur for driving rings for breech-loading projectiles, £5,000 to Mr. R. S. Fraser for the plan of making guns, and £2,000 to the Rev. F. Bashforth for the advancement of the science of gunnery by the application of mathematics to ballistics, down to £50 to Mr. Armstrong (in December, 1878) for the plan of steeling the trail eyes of gun carriages and £100 to Mrs. Padwick for a suggestion by her late husband respecting studded projectiles. The grants also included £750 to Mr. Owen Jones, £650 to Mr. Thornton, and £100 to Mr. Stanton, described as inventors of revolver pistol, and £1,500 to Mr. Henry for ammunition for small arms.

The above foots up a trifle over £30,000, or $150,000; and if this is the gross amount paid to inventors during eight years, it is not much to brag of.

EGG BEATER.

The object of the invention herewith illustrated is to provide an improved egg beater, which will beat the eggs thoroughly and quickly. It is simple in construction, and not liable to get out of order. Near the bottom of the receptacle is placed the beater,



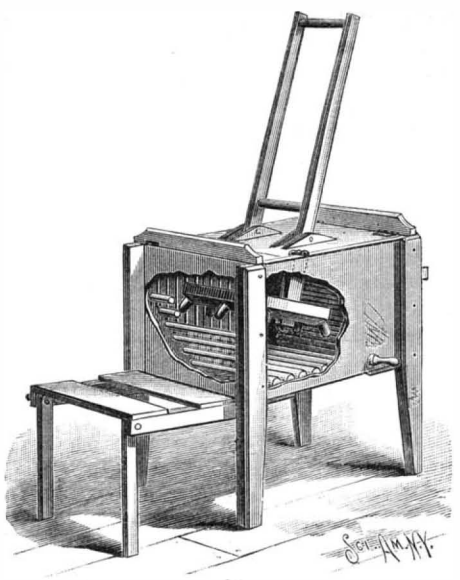
VICKERS' EGG BEATER.

consisting of a stationary and a revolving frame. The stationary frame consists of two hubs provided with spokes united at their outer ends by cross bars. The revolving frame consists of two sets of spokes and cross bars which are arranged to revolve, one inside and one outside of the stationary frame. Mounted upon the side of the receptacle, in suitable bearings, is a shaft having a crank and a cog wheel which meshes with a pinion on a shaft having a square end that fits in the end of the hollow spindle carrying the four hubs of the revolving frames. The pinion is kept in engagement with the cog wheel by a spring arranged as shown. The outer end of the pinion shaft is provided with a plate which, when pulled outward, disengages the wheels and withdraws the square end of the shaft from the hollow spindle, so that the beater can be lifted out of the receptacle. It will be seen that by turning the crank a rotary motion is imparted to the spindle and its frames.

This invention has been patented by Mr. William Vickers, of 107 Palisade Avenue, Jersey City Heights, N. J.

WASHING MACHINE.

The bottom and end surfaces of the inside of the tank are provided with horizontal strips, while the sides have vertical ones. The hinged cover of the tank is formed with two apertures through which pass the two lever arms of the pounder, being pivotally mounted in blocks placed alongside of the apertures. The pounder or rubber consists of a block of wood having a number of pins projecting from it; there is one pin at each corner, one at the center of each side, and four projecting from the lower surface. In the upper face of one of the cross strips is a soap box having holes in its bottom through which the water drains off. At one end of the machine is arranged a folding



KRAMER'S WASHING MACHINE.

platform, as shown in the engraving. After the clothes have been thoroughly washed, they are passed through a wringer secured to the end wall of the tub, when they drop directly into a basket placed upon the platform.

This invention has been patented by Mr. Henry Kramer, of Grant Park, Ill.

EVERY timber limit of any value in the Ottawa District that has recently been offered for sale has found ready purchasers.

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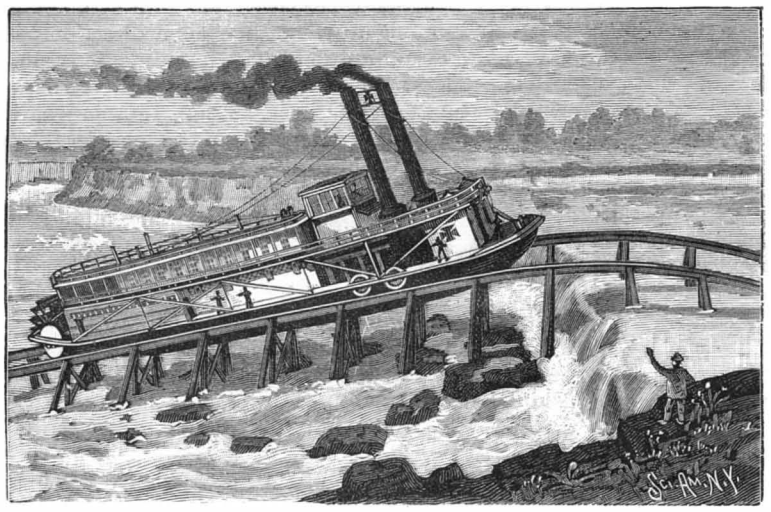
APPARATUS FOR CARRYING VESSELS OVER OBSTRUCTIONS.

This apparatus is designed for carrying vessels over obstructions, such as rapids and falls in rivers, that would otherwise not be navigable, so that a continuous transport upon such rivers is rendered possible. The steamboat is provided with wheels mounted upon a truck placed near the bow. These wheels are arranged within a guard rail, that prevents them from being injured when the boat is lying against a wharf, and are designed to run upon rails carried by a suitable trestle. As here illustrated, the stern is supported by wheels carried upon the extended paddle-wheel axle; the necessary power to move the vessel along the track is here applied. Barges that are to be towed by the steamboat are furnished with suitable trucks and wheels to run upon the rails. In certain cases the barges might be towed over the obstruction by means of a stationary engine, which could, if needed, be employed to assist the steamboat.

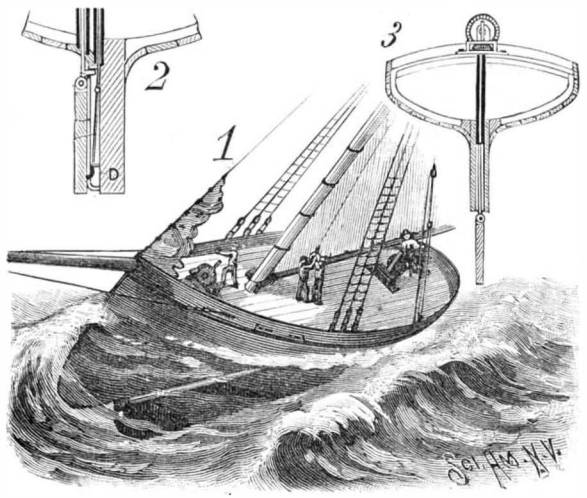


GRONDAHL'S APPARATUS FOR CARRYING VESSELS OVER OBSTRUCTIONS.

This invention has been patented by Mr. W. A. Grondahl, of Portland, Oregon.

SWINGING CENTERBOARD FOR VESSELS.

The construction of this centerboard is clearly shown by the accompanying engraving. It is preferably made of metal, several tons in weight, and is hinged to the lower ends of rods, so that when lowered it is free to maintain a vertical position in the water, no matter to what extent the vessel may heel over. This prevents leeway of the vessel, while the weight tends to right it; and as the centerboard always presents a vertical surface in the water, it causes the vessel to more readily answer the rudder. The upper parts of the rods are screw-threaded, and are provided with suitable gearing by which they may be raised or lowered. In the construction shown in the sectional view, Fig. 2, the side of the keel is provided with two bars, that stand out from the keel. On the lower ends of the lifting rods are eyes that run upon these bars. Provision is made for holding the lower edge of the centerboard against the side of the keel when it is raised.



[DEERING'S SWINGING CENTERBOARD FOR VESSELS.

The lifting rods are inclosed in tubes, which may be fastened by screwing them into the wood of the vessel or into a screw cap below, fitted for that purpose. This method saves the cutting of floor and timber and the cost of building walls, while additional space is obtained for the carrying of cargo. There is no danger of the cargo being shifted against the sides of the centerboard well and causing a leak. This swingboard may be used the whole length of a vessel's bottom. When a vessel is rolling, the great resistance offered by the common centerboard sometimes causes trouble by breaking the board or opening the vessel. This centerboard obviates this danger, as the vessel simply swings each side of it, like a buoy riding to an anchor.

This invention has been patented by Mr. James A. Deering, of 44 Wharf Street, Gloucester, Mass.

Yellow Light for the Dark Room.

For the covering of glass for dark rooms and developing lamps, Dr. Stolze, in the *Wochenblatt*, proposes an emulsion made by dissolving 10 parts of nitrate of lead in 100 parts of water. To this solution is added, constantly stirring, either 6 parts of neutral chromate of potash or 4 parts of the bichromate. This emulsion is cooled, chilled, reduced into nodules, and washed. After being liquefied, glass plates can be coated with it in the same manner as ordinary emulsion plates. Such a light acts exceedingly well, and can be used with great safety for the handling and developing of plates. The color is of a pure yellow, and appears very light to the eye. By giving a thinner or thicker coating, the color and opacity can be easily regulated. To protect these plates from moisture, it is advisable to coat with a crude collodion to harden them, or a chrome alum bath will do as well; and to prevent cracking or tearing when exposed to the heat of a gas or lamp flame, a little grape sugar is added to the emulsion; this will make the coating pliable. Another method for making red glass for the dark room was lately given by M. Cassau in the *Photographisches Archiv*. Five grammes of carmine are dissolved in 40 c. c. of ammonia solution. Two grammes of picric acid are dissolved in 450 cubic centimeters of water, to which 7 grammes of glycerine are added. In this last solution 50 grammes of hard gelatine are allowed to soak one hour, and afterward dissolved in the water bath. When the gelatine is thoroughly dissolved, the carmine is added to the mixture. While warm, it is applied to an ordinary sheet of glass or window pane with a wide brush. As soon as the first coat is thoroughly dry, a second or third can be applied until the desired density is arrived at.

A SIMPLE METHOD OF INSULATING UNDERGROUND AND OTHER WIRES.

The illustration herewith shows an easily applied form of electrical insulation, whereby a great many wires may be placed in a small space, and all will be readily accessible at any point of the line. The insulation is formed of sheet material, such as rubber, bent into reverse pockets, as shown in Fig. 2, and supported in form for use by spring clasps, preferably made of wood, such as hickory, these clasps being light and thin enough to be easily bent to the desired shape. In combination with such insulation a covering of waterproof canvas is used, as shown in Fig. 3, inclosing the insulator and wires, strengthening the insulation and excluding moisture and dirt from contact with the conductors. The whole is carefully insulated, and constructed without the use of metal. The alternating loops or spring clasps of wood are secured to the insulating sheet at short intervals, say at a distance of about six inches from each other, and six conductors are preferably arranged in each insulating covering, as being about the number which can be most conveniently handled in manufacture and in placing in position for use. A cable composed of ordinary main line wires for aerial and underground purposes is thus quickly formed by hand. When applied aerially, it may be secured to the poles without cross arms and glass insulators. This cable may also be emptied, for repeated use.

This method of insulation will permit the easy tapping of any line, and making an outlet with connecting wire to any building or office where groups of wires pass. Compactly grouped, with canvas covering, the wires cannot be mixed and twisted; and the wires can be placed within the insulating covering when they are not absolutely straight, the clasps making them all parallel with each other. The illustration shows how this form of insulation can be used beneath a street pavement, by inserting a wooden box near the surface, which would hold, if one foot square, over 1,200 wires insulated according to this plan. The construction of this continuous insulation is simple and inexpensive, and it is designed for aerial and underground electric conductors, for telegraph, telephone, and electric light circuits.

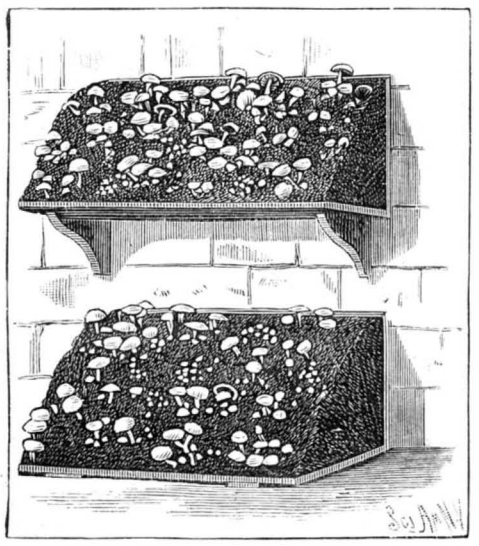
This invention has been patented by Mr. Samuel F. McGill, of Keene, N. H.

IF the manger or feed box be so foul as to emit a sour smell from any cause, it should be carefully cleansed and washed with a solution of soda or potash until perfectly sweet again.—*Lewiston Jour.*

MUSHROOMS ON SHELVES.

Short horse droppings, partially dry, thrown in a heap and allowed to ferment, form the right kind of material for raising mushrooms artificially. A good way is to build shelves on the wall of a shed or cellar, as shown in the illustration; fill each full of this material; press the droppings close; cover with two or three inches of soil. Allow the bed a few days for the heat to rise, when it is ready for spawning. This spawn is sold by seedsmen in the form of bricks, which have to be broken up into small pieces about the size of a hickory nut, and set into the bed just below the soil.

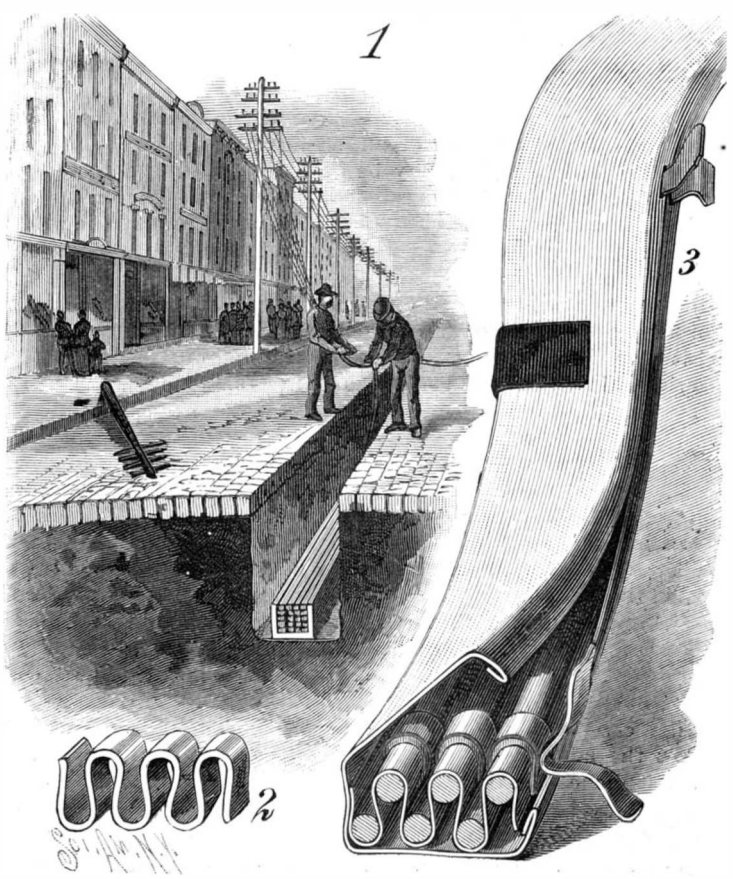
If the bed is right, having a gentle heat and a little moist, not wet, the spawn will quickly spread through the whole mass, and in about a month the little white buttons will appear all over the beds, and in a very short time after the full-sized mushrooms. Any position that can be kept not warmer than 65° or 70°, and not colder than 50°, will grow them the whole year through, but beds require to be renewed after a second crop, which can often be had from the same spawning. Any place light enough to work in will be light enough to grow mushrooms; indeed, some grow them without any light.—*Country and Town Journal.*



MUSHROOMS ON SHELVES.

Sawdust for Cleansing Garments.

Mr. Scott proposes to cleanse garments by submitting them to a uniform friction produced by sawdust from hard wood, and in connection with benzine, naphtha, or analogous solvents. The garments impregnated with any of the above solvents are placed in a revolving apparatus along with sawdust of mahogany or any other suitable wood. By the employment of this wood powder it is stated that an economy is effected of 25 to 27 per cent of the cleansing material employed, and it is stated besides that the brightness of the colors is not impaired. The principle is not altogether a new one, since dyed skins, or rather skins the wool or fur of which has been dyed, are very often exposed with sawdust in a revolving cask, not only to remove any adhering particle of color which may not have been fixed on the fiber, but to give at the same time a kind of finish by the gentle rubbing action.



McGILL'S INSULATOR FOR ELECTRICAL CONDUCTORS.

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A Model Cholera Hospital at Rome.

The London *Globe* gives an interesting account of a new cholera hospital at Rome, which the Pope has caused to be built. Contact with the outer world is carefully guarded against by grated windows, telephones, and by a revolving barrel, with half its circumference open, by which provisions are taken into the hospital. The water supply is drawn from a well, and is quite separate from the city supply. The drain is formed of an iron tube, sixteen inches in diameter, the joints being hermetically sealed with lead. There is a disinfecting boiler in which corrosive sublimate is placed. There is a room called the "chamber of observation," which has a staircase leading up to the first floor. In this room dead bodies are placed for a given time, as it is well known that cholera patients often show signs of being dead when really only apparently so. The room is, by means of an electric apparatus, in communication with the director's office. The body being laid on a bed, both hands are put into a sort of copper muff; between the hands is put an instrument so sensitive that, should there be the slightest movement of the hands or any other part of the body, this instrument would instantly close the electric circuit, and the bell in the director's office would be set ringing; at the same moment another instrument registers the number corresponding to the bed upon which the body is lying. The chamber is warmed by steam, so as to facilitate resuscitation. The laboratory is provided with a gasometer for the storage of oxygen, which is taken to the wards for administration in gas bags. On the ground floor are four wards for doubtful cases. Should they get worse, they are sent up in the lift to the cholera wards above, their clothes and bed linen being immediately burned. Another room is set apart for women in childbirth, and there are two more for undressing patients, so that the infected clothes may be destroyed, the Pope furnishing new clothing for all recovered cases. The cubic space allowed for each bed is thirty-six cubic meters. The ventilation is carried on by means of funnels with gas jets below. The chapel is in communication with the sacristy of St. Peter's, so as to form an easy access for the Pope, should he wish to visit the hospital; but before returning into the sacristy, his Holiness and suite would have to go into a room near it for disinfection.

Detection of Leaks in Water Mains.

The microphone is now being used in Germany for the purpose of detecting loss of water through leakage in town mains. The apparatus consists of a steel rod, which is placed upon the cock in the neighborhood of which the leak is suspected, and a microphone attached to the upper end of the rod. A dry battery and a telephone complete the equipment. No sound is heard in the telephone if the cocks are closed and no leak occurs; but a leak of even a few drops through a badly fitting cock causes sufficient vibration in the pipe to affect the microphone, and to give audible sounds in the telephone. At the recent meeting of gas and water engineers in Eisenach, it was stated that the apparatus is so simple to handle that, with a little practice, ordinary workmen are able to detect and localize any leak.

A UNIQUE SYSTEM OF WATER WORKS.

BY E. O. HOVEY.

As everybody knows, water is frequently raised to a desired height by means of a hydraulic ram set in a stream at the foot of a hill, or at the bottom of dam, or at some other place where there is a natural fall of water; but at Elk River, Minn., there is a peculiar arrangement, a description of which may prove to be of interest.

The town is situated at the junction of the Elk and Mississippi Rivers, thirty miles northwest of Minneapolis. The geological formation is the area of modified glacial drift of central Minnesota. About half a mile northeast of the station the railroad passes within a few yards of the southwestern edge of a tamarack swamp, in which water is found on or near the surface. For a long time it has been known that, within a limited area southwest of the railroad at this point, good water could be had at a depth of eight feet, while just outside of this area water could not be found short of eighteen feet. The idea occurred to Mr. T. S. Nickerson, who lives at Elk River, and is water supervisor of the Breckenridge division of the St. Paul, Minneapolis, and Manitoba Railroad, that a hydraulic ram might be set so as to utilize this difference of water level. Test holes twelve feet deep were sunk with an elongated post hole auger, at the points marked A, Fig. 1, to determine the location of the edge of the basin of water standing at eight feet. Water failed to come into these holes, but at the point, B, Fig. 1, water was struck at the required depth. The operations which pertained directly to the setting of the ram are of especial interest. On a line supposed to be perpendicular to the rim of the basin a ditch sixteen feet long, two and a half feet wide, and about twelve feet deep was dug to allow the water to flow off while the "supply" well was in process of construction. This well is twelve feet in circumference and twelve feet deep, The first six inches of the well and ditch were cut through the light and sandy but fertile soil characteristic of this region, the next six and a half feet through loose gray sand. Then, on the line between the well and the ditch, the diggers struck a dike two feet wide at the top, but soon increasing in width to four feet, composed of coarse sand so firmly cemented by infiltrated oxide of iron and carbonate of lime as to render the use of the pick necessary in removing it. This dike is impervious to water, and, as shown in Fig. 2, has an inclination at this point of about 75° south of west. Northeast of the dike the well passed through coarse gravel containing many large stones, while southwest of it nothing but the loose gray sand was found. In the coarse gravel a copious supply of water was met with, which flowed off freely through the loose sand of the ditch.

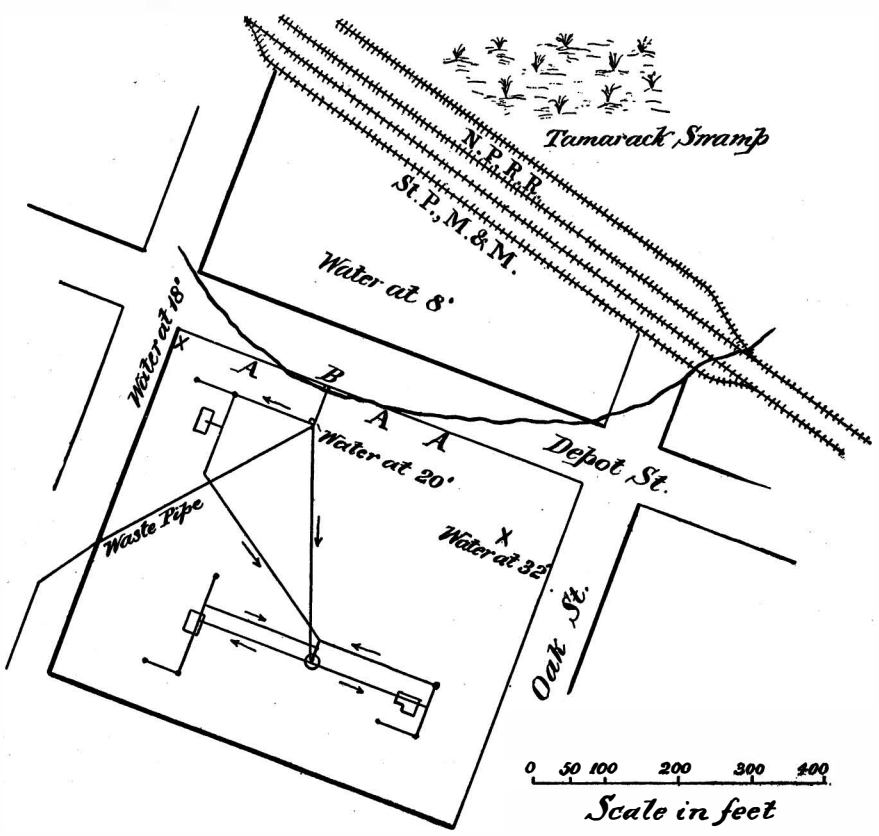

Fig. 1

A two and a half inch iron pipe was laid in the bottom of the well and ditch, the well was bricked up in the usual way, and the trench in the dike outside of the well was filled in with cement to make a water tight joint about the pipe and to prevent the washing away of the dike. Fifty feet southwest of this well another one, called the "waste" well, eight feet square, was sunk to the depth of twenty feet, and cairned to prevent caving. Water was met with at this depth, or the well would have been made deeper. A No. 6 hydraulic ram was then placed in the waste well at a depth of 16 feet, and was connected with the two and a half inch iron pipe mentioned above. The ram there has a head of water of eight feet, and it furnishes three houses and their dooryards with an abundance of water. The arrangement of the pipes leading from the ram is illustrated in Fig. 1. Each pipe, after making the circuit of the house and dooryard which it supplies, is connected with a 250 bbl. tank, the bottom of which is 16 feet above the ground, which connection greatly increases the force of the stream at each faucet. In each pipe, after it passes through the house, there is a check valve to keep the water from flowing back from the tank through the house.

For about a year, *i. e.*, until the present summer, the waste water from the ram found free discharge through the loose sand surrounding the well; but lately the sand has seemed to be saturated with water, and drainage has not been sufficiently rapid. Therefore, three months ago Mr. Nickerson laid a two inch iron drain pipe from a depth of 18 feet in the waste well to a point 1,200 feet distant on the terrace of the Elk River, and the waste water is easily disposed of through this outlet.

The water within the basin is strongly impregnated with iron and has but little lime in its composition, while that from wells without the basin contains much lime and but little iron. The water from the tamarack swamp is like that found in the basin. The dike of coarse sand has been cut into at one other place, and found to trend in such a direction as to warrant the supposition that it forms a retaining wall on at least the southern and southwestern sides of the basin and tamarack swamp, thus preventing their waters from flowing off into the loose gray sand and descending to the general water level.

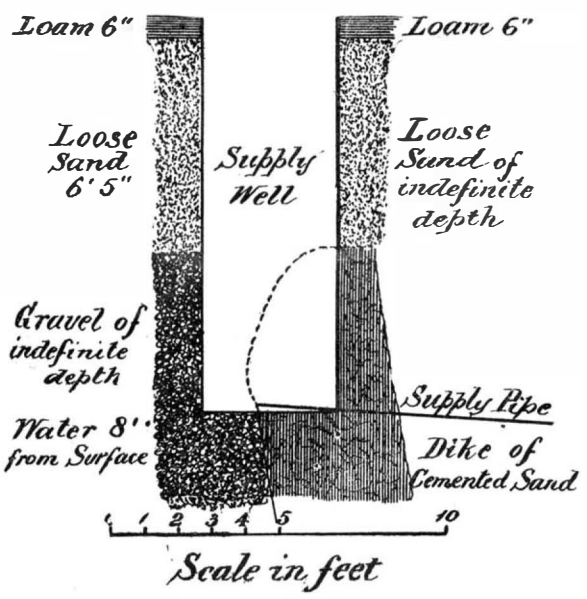

Fig. 2.

Mine Drainage.

In mining anthracite coal, it is necessary to keep the mines clear of water, which accumulates in large quantities, and which must be removed either by gravity or by powerful engines and pumps, and must find its escape through the natural water courses. This water is acidulated with sulphuric acid, and consequently is destructive to iron pipes, kills fish, and cattle refuse to drink it. The Pennsylvania Coal Company owns a large colliery in Scranton, called the Gipsy Grove Works, and the water from this mine is pumped and discharged into a small stream called Meadow Brook, a tributary of the Lackawanna River. In 1868, J. Gardner Sanderson built a handsome residence on Meadow Brook, below the colliery, on which he made a fish pond and provided machinery to force the water of the brook into tanks in his house for domestic use. As the operations of the colliery grew and the discharge of mine water increased, the water of the brook became so contaminated as to destroy Mr. Sanderson's pipes, kill his fish, and, indeed, the water became totally unfit for use. He then sued the coal company for damages.

The Supreme Court of Pennsylvania has given judgment against the Sandersons, and the matter is finally settled.

In the decision, the court says:

"If damages may from time to time be recovered, either in the present form or as for a nuisance, punitive sums may be resorted to to prevent repetition or to compel the abatement of the nuisance; indeed, if the right to damages in such case is admitted, equity may, and under the decisions of this court undoubtedly would, at the suit of any riparian owner, take jurisdiction, and, upon the ground of a continuous and irreparable injury, enjoin the operation of the mine altogether. . . . The defendants have done nothing to change the water or diminish its purity, save what results from the natural use of their own property. The water, as it is poured into Meadow Brook, is the water that the mine naturally discharges; its impurity arises from natural, not artificial, causes. The mine cannot, of course, be operated elsewhere than where the coal is naturally found, and the discharge is a necessary incident to the mining of it. . . . The right to mine coal is not a nuisance in itself; it is a right incident to the ownership of coal property, and the owner cannot be held for permitting the natural flow of mine water over his own land into the water course. . . . The defendants were engaged in a perfectly lawful business, in which they had made large expenditures, and in which the entire interests of the community were concerned; they were at liberty to carry on that business in the ordinary way, and were not, while so doing, accountable for consequences which they could not control."

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Correspondence.

The Recent Earthquake.

To the Editor of the Scientific American:

Since forwarding you my reply to P. M. F.'s criticism in your issue of Oct. 9 of my article relative to the earthquake, I have to supplement the same with the following clipping from the Washington *Star* of October 13:

"BENEFITED BY THE EARTHQUAKE.

"A strange result of the recent earthquake has been discovered by Prof. John Collett, the Indiana geologist, who states in an interview that a number of wells bored in Indiana and Ohio for gas or oil yielded nothing before the earthquake, but since that occurrence gas in good paying volume and oil in considerable quantity has come into many of them."

This seems to substantiate in a measure the theory originally advanced by me. My previous reply shows the insufficiency of P. M. F.'s reasoning, and the quoted article above proves that his averment as a fact that no such effect of the earthquake had been observed was premature. EDWARD W. BYRN.

Washington, D. C., Oct. 13, 1886.

Home-made Indian Clubs.

To the Editor of the Scientific American:

Possibly I can suggest a cheaper, more easily obtainable, and more durable home-made Indian club than your issue of August 14 presents.

Between twenty and twenty-five years ago, when the rage for Indian clubs was coming on, and when those who wanted them had to get them turned to order at an expense of a couple of dollars or more, and when my new domestic alliance absorbed such change to keep the pot boiling, I drew from our pile of fire wood, obtained from torn-down buildings, a couple of pieces of old three inch joist, and with hatchet and saw made a pair of clubs that I have used almost daily ever since, and although flattened (rather than entirely round), in order to secure sufficient weight, they fully "fill the bill." W. H. WETHERILL.

Philadelphia, October, 1886.

Great Rise of the Sea at Sabine Pass.

Sabine Pass is an inlet from the sea which forms the dividing line between the States of Texas and Louisiana. The town of Sabine Pass, near the sea coast, had 400 inhabitants. It is connected with the mainland by a railway. The adjoining town of Johnson's Bayou had a population of 1,200, Radford and other towns still more. The whole region for many miles in all directions is low ground. The settlements were mostly built on ridges, rising ten or twelve feet above sea level. On Tuesday, October 12, a great storm prevailed, during which the sea rose to an unprecedented height and swept everything away—human beings, dwellings, live stock, all were hurried to destruction.

A dispatch to the *Times-Democrat* says: "The village of Johnson's Bayou is a high ridge on the sea coast, and the bayou, from which it takes its name, runs through the inhabitable parts of that section of the settlement, in which is also situated the post office station known as Radford. They are in Cameron Parish, on the Louisiana shore, six miles east of Sabine Pass. The bayou is nineteen miles in length, and varies from one to four miles in width. Ridges face the Gulf 12 feet above the sea level, and in the rear is a dense and impenetrable marsh. The population on Monday, Oct. 13, numbered 1,200 souls; to-day 85 of that number are counted with the dead. Forty of their bodies have been recovered and consigned to graves in the shell reefs, while the decomposing corpses of the remaining 45 lie festering in the marshes. Radford was very thickly settled and populous. It boasted its cotton gin, and cotton and cane plantations. It was the head of navigation, and its stores were many, principally those run by J. Paveto, who also operated the gin and turned out annually 800 bales of cotton produced in that section. The other stores were owned by A. B. Smith & Co. and J. Griffith, general merchandise dealers, and other small merchants constituted the commercial community. Cotton and sugar are the chief products of the ridges, which are composed of the richest and most fertile grazing country, and the parish had 8,000 head of cattle and horses, owned by a thriving community. Communication with the outer world was through two steam vessels, both owned in Johnson's Bayou and Radford, while a fleet of trading vessels plied the waters of the bayou.

"At 4 o'clock on Tuesday afternoon the storm descended upon the people, and everybody took to their homes and waited with bated breath the fate which they foresaw as doomed to be theirs. The waters, rising with the wind, swept through the lower stories of the buildings, driving the affrighted people into the attics and upon the roofs. By 10 o'clock at night the first ridge, 12 feet above sea level, was 10 feet under water. House after house fell in, or was swept away, either burying the poor people in the debris or hurling them into the hissing waters. The cotton and the stores next succumbed, and Radford and Johnson's Bayous were destroyed as completely as if an invading army had done the work. The people could only cling to each other and pray for mercy and for the souls of those whose despairing shrieks rang in their ears. For twelve hours the storm raged over the devastated settlements, and then came a lull. Hope revived as the water receded and the storm passed away, and the survivors gathered on elevated points, viewing the scene of desolation around them."

The keeper of the lighthouse at Sabine Pass, who lived with his family in a small brick house near the lighthouse tower, succeeded in getting all the members of the family into the tower before his dwelling was submerged. All were saved. He says:

"By noon the wind, still holding north and east, began to shake our house. The water came up and things were floating around. It was time for us to leave, and with the women and children we took to the lighthouse; the house was going then, and we did not get in the tower too soon, for shortly thereafter the house went to pieces. It was hard work getting to the tower, but we got there. We had no food, no covering, and only three gallons of oil. Everything went with the building. Then the storm increased in fury. The water rose above the top of the lighthouse door, 10 feet from the ground. It entered the tower, and the draught ascending upward kept lifting the trap door leading to the lamp. The trap door was held down by a hundred pound weight, yet it came up so that one of us with the oil had to add our weight to keep it down. If that trap door had given way, the light would have gone out, and who knows how those would have fared also? The spray from the seas, which with the winds caused the lighthouse to tremble to its very foundation, dashed up through the slit, and that slit is 50 feet from the ground."

Captain F. A. Hyatt and William Guy report that they had a singular experience as members of the relief committee, on their way to the Pass. The train in which they were traveling stopped on a dump five miles from the town. The water all round this neck of land, on which was placed the track, was fully 8 feet deep. The hands of Messrs. Hyatt and Guy are blistered from fighting snakes which literally covered the dump for a distance of five miles. There were thousands of water moccasins from the overflowed district taking refuge on the narrow stretch of land, and every step across it had to be fought through the twisting serpents, many of them the deadly stump-tailed moccasins, larger than a man's arm. Wild cats, also, frenzied at the water's fury, rushed pell-mell upon pedestrians, while raccoons and every variety of animal snapped at passers-by with hydrophobic rage. Many times the pedestrians left the dump and swam around the angry reptiles rather than try to pass them. Captain Hyatt alone killed over 150 snakes during his walk of five miles, which consumed about ten hours. Mr. Guy says that no money could tempt him to make his trip over again. In stepping about in the dark he was tripped and thrown by a snake two inches in diameter and fully five feet long.

Earthquakes.

What is known and believed about earthquakes by geologists was condensed into an hour's talk by Professor John S. Newberry, in Hamilton Hall, Columbia College, at a recent meeting of the New York Academy of Sciences. In the course of the lecture, which took an extended range, the character and causes of the recent disturbances on this continent were referred to as likely to be better understood hereafter than at present. The speaker said that although the Charleston earthquake had produced startling effects and killed some people, as an earthquake it was not a very great affair. There was nothing remarkable in its phenomena. There had been earthquakes that had carried off 10,000 and 20,000 and 60,000 persons at once, and 250,000 lives were reported to have been lost in the island of Java in what might be regarded as a single earthquake.

An exhaustive inquiry in regard to the seat and depth of the Charleston earthquake had not yet been made, he continued. From all quarters, inquiries had come to him about the Charleston earthquake. Because he was a geologist he was naturally appealed to for information in regard to the most striking of earthly phenomena, and while he did not assume the title of "Professor of Earthquakes," he felt that he ought to answer the questions as far as he was able. The peculiar terror inspired by these shocks was not lessened by familiarity with them. It was not surprising that a profound sensation had been caused by the Charleston disturbance, and that the statements with regard to it were widely contradictory.

An earthquake is neither a novel nor a mysterious occurrence. It is among the most common of terrestrial phenomena. Not an hour, perhaps not a minute, passes in which some portions of the earth are not vibrating from this cause. An earthquake is a movement caused by the shrinking, from the loss of heat, of the interior of the earth, and a falling in of portions of the crust in consequence. That the interior of the earth is intensely hot is indicated by wells and mines sunk in all parts of the world. Heat increases about one degree Fahrenheit for every 50 feet below the earth's surface. Dr. Newberry gave the temperature of different wells in this country and Europe as demonstrating this, instancing particularly a well in Europe sunk 3,390 feet, at which depth the thermometer indicated 115°, and another a little over a mile in depth, where the temperature was shown to be 131°. There were some exceptions to this rule, but the statement that below 3,000 feet in certain wells it had been found that the temperature declined was a fraud. At the rate that he had indicated, the heat would be so fervent that all substances would be melted. It was believed that the earth's crust was thicker than this would indicate, because the increase of heat might be slower at a great distance from the surface. The heat of the interior was constantly escaping to the surface. Since the outer crust had lost its heat, it no longer contracted.

Mountain chains resulted from readjustments of the earth's surface caused by earthquakes. The folds and fractures seen in every mountain belt could not have taken place without great disturbances, and in every mountain range are evidences of many earthquakes. In the highest mountain ranges, like the Himalayas, the work of elevation is constantly going on. Displacements are constantly taking place all over the world. They occur in paroxysms, and the pressure being relieved, earthquakes follow. As the population of the earth increases, the number of observers increases, and the loss of life is correspondingly greater.

In New England, during the last century, there have been a great many earthquakes. In 1727 the country about Newburyport was shaken up in the same way that it had been at Charleston recently, but the damage was small in comparison. Chimneys and stone walls were thrown down, there were ruptures of the surface, and jets of sand were thrown up. In 1638 there was a great revolution in the topography of the country, and as shown by Brigham in his work on volcanic eruptions in New England from 1638 to 1869, there were 231 earthquakes worth chronicling during that period, besides many smaller ones.

At the time of the shock felt in this city on August 10, two years ago, the Professor was alone in his room in the college. He heard a sound like the rumbling of a heavy wagon in the street, and the buildings shook. In the geological cabinet the marbles were thrown down in the case. In Japan, where there are incessant earthquakes, an extensive system of taking observations has been instituted. It will doubtless be found that the line of disturbance in the Charleston earthquake was parallel with the Alleghanies, and its depth from 10,000 to 20,000 feet. It is not likely that the center of the disturbance was under the ocean, as some supposed, for if it had been it would have caused a great wave. An earthquake wave coming from below often exerted its greatest force on the surface, as in the game played by boys, called "snapping the whip," the last boy felt the effect the most.

The place of disturbance causing the earthquake in Charleston was, in the speaker's opinion, to the westward of that city, and not underneath it. The earthquake was in the old crystalline rocks that underlie Charleston, stretching from the westward. It was reported that there was a slight change in the depth of the water at that place. The area of vibration was probably an ellipse, with the longest line running north and south. It has been estimated that the maximum depth of earthquake disturbances was 8½ miles, and the minimum 2½ miles. The pressure of subterranean reservoirs of water are among the causes of earthquakes. The twisting of chimneys and monuments did not necessarily indicate a gyratory motion in the earthquake. An adhesion of a portion of the base might account for it. Explosive earthquakes were probably caused by large quantities of water being brought in contact with molten lava, and steam had played a large, though generally a secondary, part in producing them. Earthquakes are merely incidents in the process of mountain building.

The theories of Sir William Thomson and others as to the great thickness of the earth's crust are now generally considered untenable, and it was believed that it was only about 50 miles in depth. It was probable that the viscous zone acted as a buffer between the liquid interior and the solid crust. The flexibility of the crust showed that it was not of great thickness. The lecturer dwelt upon the proximate causes of earthquakes, such as atmospheric pressure, and said it was not so absurd as some thought to believe that atmospheric conditions had something to do with them.

Why the Compass Went Wrong.

The Orizaba is a new steamer. The compasses are Sir William Thomson's patent. When swinging the ship, the reading of the bearings by one of the officers was always different from that by other officers. This led to a wordy contention, the officer maintaining that his reading was correct. The difference was at last discovered to be due to that officer having on a steel truss. These compasses are so sensitive that they are affected by such very minute disturbing influences. The officer had to go on shore and provide himself with a truss constructed free of iron.

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A Cliff of Glass.

Among the scientific papers that will appear in the appendix of one of the forthcoming reports of the Geological Survey is one by Professor Joseph P. Iddings upon the obsidian cliff of Yellowstone Park. This cliff is an elevation half a mile long by from 150 to 200 feet high, the material of which, Professor Iddings says, "is as good a glass as any artificially manufactured." Its colors and structure not only make it highly interesting to the visitor, but furnish to the scientific investigator phenomena of importance. The cliff presents a partial section of a surface flow of obsidian that poured down an ancient slope from the plateau lying east. It is impossible to determine what the original thickness of this flow may have been. The dense glass that now forms its lower portion is from 75 to 100 feet thick, while the porous and pumiceous upper portion has suffered from ages of erosion and glacial action. A remarkable feature of the cliff is the development of prismatic columns, which form its southern extremity. These are of shining black obsidian, rising from the talus slope, and are from 50 to 60 feet in height, with diameters varying from two to four feet. The color of the material of this cliff is for the most part jet black, but much of it is mottled and streaked with bright brownish red and various shades of brown, from dark to light yellowish, purplish, and olive green. The brilliant luster of the rock and the strong contrasts of color with the black are very striking. In places, the glass in the process of cooling has been broken into small angular pieces, which have been again cemented by the later flow, producing many-colored and beautiful breccia. In some places, the material shows a fine satin luster, while in others a deep golden sheen is noticeable, which under the lens resolves itself into thin beams of red and yellow light. Through the black and red glass are scattered dull bluish gray patches and bands, and round gray and pink masses, the effect of which is still further to vary the appearance and beauty of the rock, and make it the most conspicuous and characteristic variety of volcanic lava known.

The Proposed French Tower.

The Eiffel tower, 1,000 feet high, which is to be erected in Paris for the exposition of 1889, is likely to afford plenty of excitement to Parisians before it is completed. The first step is about to be taken in ascertaining what curve is to be given to the sides. A chain or cord suspended between two points forms a catenary curve corresponding with the weight. Now it is supposed that something of the kind also occurs when the suspension is vertical. The engineers have therefore arranged to cause a balloon to ascend to the height of the proposed tower. From the boat, ropes will be hung to the ground and fixed there. From their curvature, the contour of the tower will be derived. It is a novel experiment, but, as there is some difficulty in arranging the slope of an ordinary lighthouse, we cannot expect that a colossal tower, made of iron plates, is to be designed without much deliberation.

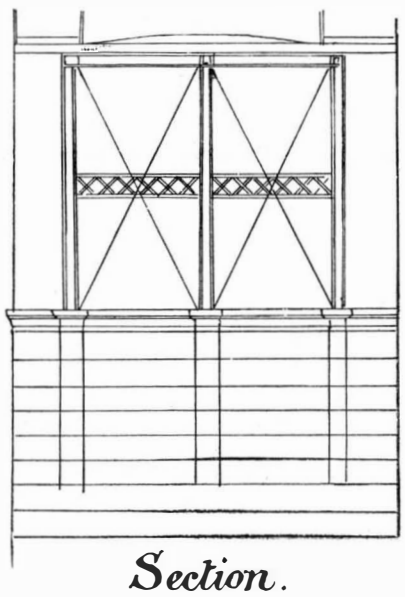
DOUBLE PARABOLIC BRIDGE, SUBMITTED IN COMPETITION, FOR CROSSING THE HARLEM RIVER AT 181st STREET, CITY OF NEW YORK.

BY GEO. ED. HARDING, CIVIL ENGINEER AND ARCHITECT, N. Y.

The main span is to have one clear span of 450 ft., with two end spans of 225 ft. each, composed of low Bessemer steel rectangular braced tube parabola arch, with Bessemer steel linked catenary, braced with the necessary struts and bracing.

The two end spans, where the thrusts and pull of the principal members unite and equalize each other, are anchored down at their respective connections, and so arranged that the necessary lateral movements for expansion and contraction are allowed for.

The iron framed supports which receive the thrust



Section.

of the arch and support the catenary are in longitudinal section that of an isosceles triangle, and have lateral play allowed by resting on bed plates having steel rollers.

The ultimate strength of the steel used is as called for, viz., 60,000 pounds tensile and 190,000 compression. Elastic limit, 36,000 pounds, with 10 per cent extension.

All rock to be leveled off in horizontal steps when used as foundation.

All piers to be faced with granite, 20 to 30 in. thick, averaging 6 and 8 ft. long, with suitable headers binding to the interior stone of limestone, uniform with facing courses.

Piers for the approaches not to be solid work, but lightened by interior arches, as explained by details if required.

Foundation for northern piers to be of concrete masonry or beton nearly to surface of ground.

The coping, cornices, and parapets on the approaches to be moulded as per details, but the general face stone is designed to be rock faced, with draughted joints.

All cement above ground to be best Portland tested cement; for concrete foundations, best American Rosendale or Taylor's, with clean 2 in. broken trap.

The ornamental arches covering the parts of the main span and the two side spans, as shown in the elevations, are to be of best quality cast iron, carefully painted with one coat of metallic paint before delivery, and to have two additional coats of best Atlantic Mills lead before the final coat of Sienna lead, with tints as desired.

The entire metal work of the bridge to have four coats of best paint, as directed by the chief engineer.

Ornamental railings on the out and inner sides of sidewalk over the three central spans and on the inside of the walk on the approaches (the stone parapet there being on the outside), with posts, to be of best cast iron, selected pattern.

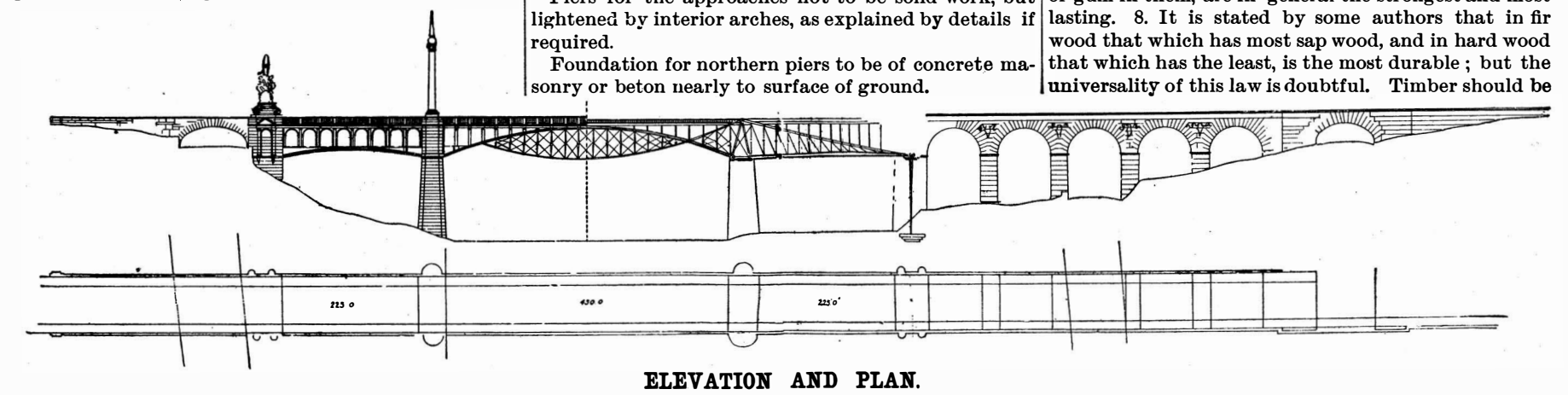
The roadway to be as called for, of corrugated steel plates, concreted with a cover of Trinidad asphalt, with Belgian block granite paving. Sidewalks similarly arranged with bluestone tiles and marble borders.

The designated weight of 200 pounds per square foot distributed load above the full weight of the superstructure, with the live load of 100 pounds and the wind pressure of 400, has been allowed for in the sections.

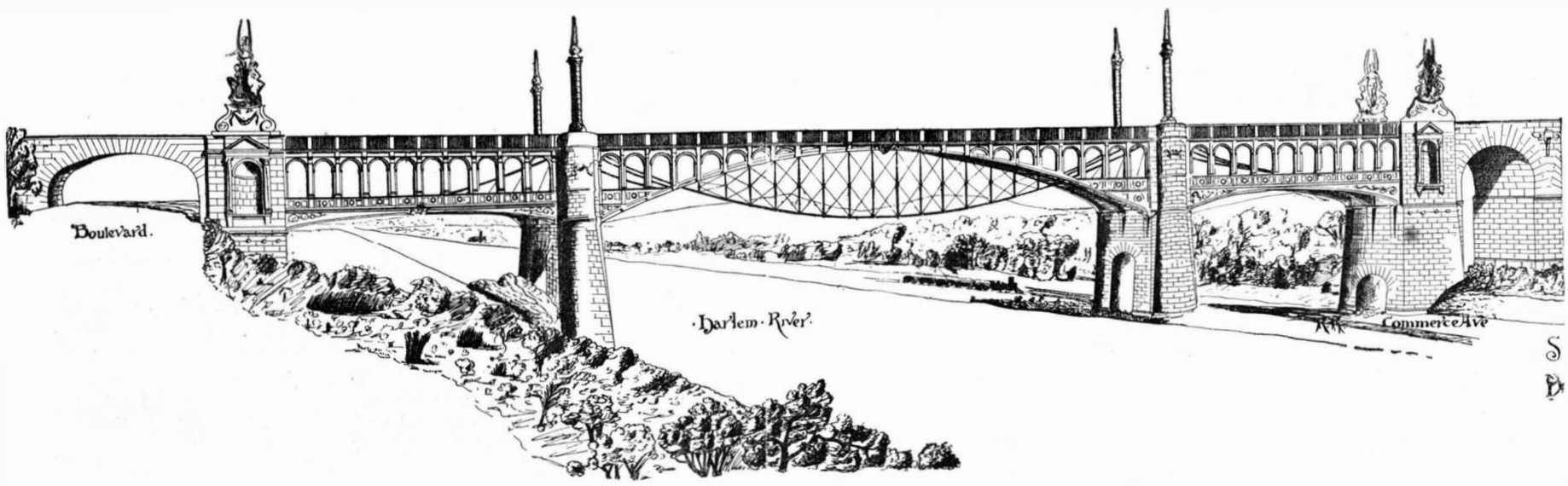
The entire strutting of the superstructure is also to be of Bessemer steel, and also the main floor girders.

Bracing, wind ties, and anchorage links to be of best quality Swedish wrought iron.

The four ornamental groups of figures at the beginning of the approaches to be of bronze, are alike, and consequently have been estimated at $10,000 each.



ELEVATION AND PLAN.



DOUBLE PARABOLIC BRIDGE FOR HARLEM RIVER, N. Y.—BY GEO. E. HARDING, C.E.

Characteristics of Good Timber.

There are certain appearances which are characteristic of strong and durable timber, to what class soever it belongs. 1. In the same species of timber, that specimen will, in general, be the strongest and the most durable which has grown the slowest, as shown by the narrowness of the annual rings. 2. The cellular tissue, as seen in the medullary rays (when visible), should be hard and compact. 3. The vascular or fibrous tissue should adhere firmly together, and should show no wooliness at a freshly cut surface, nor should it clog the teeth of the saw with loose fibers. 4. If the wood is colored, darkness of color is in general a sign of strength and durability. 5. The freshly cut surface of the wood should be firm and shining, and should have somewhat of a translucent appearance. A dull, chalky appearance is a sign of bad timber. 6. In wood of a given species, the heaviest specimens are in general the stronger and the more lasting. 7. Among resinous woods, those which have least resin in their pores, and among non-resinous woods, those which have least sap or gum in them, are in general the strongest and most lasting. 8. It is stated by some authors that in fir wood that which has most sap wood, and in hard wood that which has the least, is the most durable; but the universality of this law is doubtful. Timber should be free from such blemishes as clefts or cracks radiating from the center, "cup shakes" or cracks which partially separate one annual layer from another; "upsets," where the fibers have been crippled by compression; "rindgalls," or wounds in a layer of the wood, which have been covered and concealed by the growth of subsequent layers over them, and hollows or spongy places, in the center or elsewhere, indicating the commencement of decay.—*Professor Rankine.*

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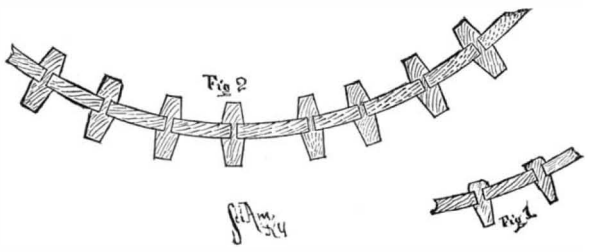
HEATING WATER RAPIDLY.

In the SCIENTIFIC AMERICAN of August 21 appeared an article copied from the *British Journal of Photography*, headed "Heating Water Rapidly." Mr. Fletcher has done himself credit in his "heating" inventions, but in the idea advanced in the item referred to, he has been fully anticipated by at least thirteen years, if he puts forth the idea as an invention. With this exception: he advises copper studs, while iron was my own medium.

With this please find sketch of an arrangement which was used in 1873 upon two steam boilers, and in 1876 upon a greenhouse boiler of 30 inches diameter, 54 inches long, which displaced two large and one small cast iron greenhouse boilers, and heated nine



thousand feet of glass far better than the three did, the previous winter, and with far less coal.

The first experiment was made by rivets 1¼ inches diameter, next the shell 1 inch diameter at small end, and set the whole length of both fire sheets and for nearly half the circumference of the boiler, 3⅞ inches from center to center in alternate rows and spacing. Fig. 1 shows first experiment, Fig. 2 the second.

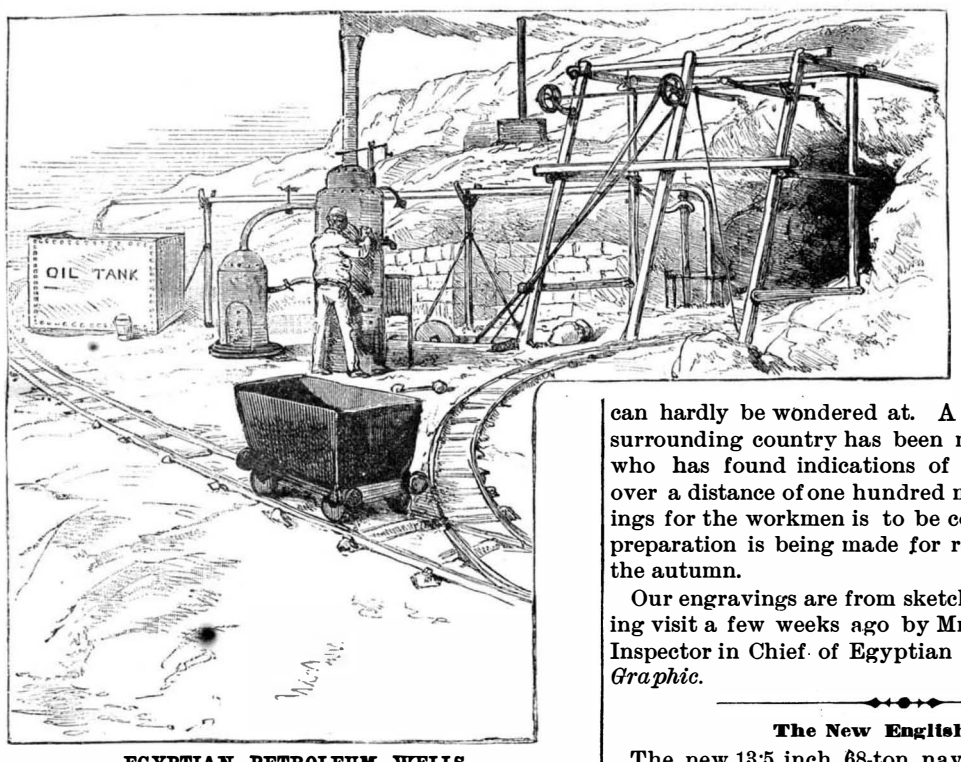
All sorts of trouble was promised by boiler makers, but no trouble or expense of any kind ever came from the arrangement or boilers. The record of evaporation was high, no leakage occurred, and not a cent was called for in repairs; and so far as my own experience goes, no other application has been made of the idea in this country. THOS. PRAY, JR.

Hartford, Conn., October, 1886.

The Pilgrim Ship Mayflower.

Amid the many mythical stories which have been afloat as to what ultimately became of the Pilgrim ship Mayflower, it will be interesting to our readers to peruse the following, which from so eminent a writer may be accepted as the true sequel of her voyaging. With regard to this famous ship, Mr. Edwin Arnold, in his delightful book on "India Revisited," says:

Among the curious treasures of the Madras Museum, which the governor has greatly developed, is a golden coin of Claudius the emperor, struck to commemorate the conquest of Britain, and discovered in excavating a foundation near Madras. What chapters of fancy



EGYPTIAN PETROLEUM WELLS.

might be written about this *aureus*, which thus strangely links the past and present of England's history, and came, perhaps, to India in the scrip of St. Thomas!

The only fact that could be mentioned by me at all to match the odd thoughts suggested by this Roman coin, with its device of *ob Brittanos devictos*, in connection with the same locality, was one regarding the famous old ship Mayflower, which bore the Pilgrim Fathers to New England. It has recently been ascertained that this vessel was chartered in 1659 A.D. by the East India Company, and went to Masulipatam from Gombroom for a cargo of rice and general produce. She was lost upon the voyage home—one of the ships whose history is linked with that of the birth and uprise of great nations, like the *aureus* in the Madras Museum.—*Old Colony Memorial.*

A Remarkable Quarry Accident.

On the 25th of September last a dreadful accident, involving the loss of eight lives, occurred at a quarry on Lake Fyne, near Glasgow, Scotland. It has been the custom, at these quarries, to have one great blast in the year. This year 14,000 pounds of gunpowder were fired in a single blast by electricity, displacing between 60,000 and 70,000 tons of rock. A steamer had brought an excursion party to the scene to witness the event, and lay about a mile off shore, with the party or board, and by agreement gave the signal for the blast with her steam whistle. About a minute after the signal the explosion took place, after which the steamer ran in, and landed passengers to visit the quarry and inspect the result. So far all had gone well. The visitors, or many of them, went up into the quarry, and were in the midst of animated conversation, when some members began to fall fainting to the ground, and the managers suddenly realized that they were immersed in an atmosphere contaminated with carbonic acid gas, or choke damp. They called out to the people to run, and in the midst of the general consternation, more and more succumbed, until 80 to 100 persons were prostrated. For some minutes people kept falling senseless, in most cases without uttering a sound. Besides eight men who were killed, a number of the visitors were injured.

The weight of powder employed would set free about 66,000 cubic feet of carbonic acid gas. This, mixing with a large volume of air, would render it irrespirable. The sulphureted hydrogen and other products would lend their aid to make the air more poisonous. The accident will probably recall to many of our readers one of the closing scenes in Wilkie Collins' novel "Armadale." Miss Gwilt is described in it as nearly killing Midwinter, by generating a gas that, entering the room in which he slept, would have destroyed him. The gas was carbonic acid gas, although the novelist does not name it, made by the amiable lady out of limestone and presumably crude hydrochloric acid. Eventually, she drags out the prostrated body of her victim, who recovers, while she, entering the room and closing the door, dies under the influence, a suicide.

The high specific gravity of the gas, as in the famous Grotto del Cane, in Italy, caused it to remain in the bottom of the quarry. Usually, a quarry after a blast is considered safe to enter. So unprecedented was this accident, that no blame seems attachable to any one concerned.

EGYPTIAN PETROLEUM WELLS.

The working of the petroleum wells at Gebel Zeit and Gemsah, in the Red Sea, has been temporarily suspended, but will shortly be resumed under the superintendence of Mr. Tweddle, who is sending out proper boring instruments, with which it is expected oil will be found in large quantities. The present borings, which extend only to a depth of 180 feet, have yielded a comparatively small quantity of oil; but when it is considered that many borings in America are 2,000 feet in depth, this can hardly be wondered at. A careful survey of the surrounding country has been made by Mr. Mitchell, who has found indications of petroleum extending over a distance of one hundred miles. A pile of buildings for the workmen is to be constructed, and every preparation is being made for recommencing work in the autumn.

Our engravings are from sketches made during a flying visit a few weeks ago by Mr. Arthur Middlemass, Inspector in Chief of Egyptian Coastguard.—*London Graphic.*

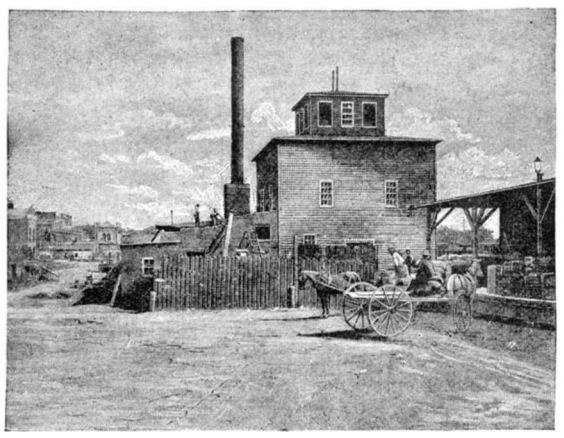
The New English Gun.

The new 13·5 inch 68-ton naval gun has been subjected to further and final trial at the government proof butts at Woolwich. After some preliminary rounds, the gun was fired with 580 pounds of black powder, with the service weight of shot. An examination of the crusher gauge, indicating the pressure in the chamber, showed that the gun had passed proof within the terms of the specification. One of the results of the recent Woolwich trials is that in future all large ordnance will have their "liners" expanded by means of special four banded proof cylinders before the completion of the rifling, so as to neutralize any possible twisting of the liners.

MR. JUAN BROWN, of Valparaiso, Chili, is at work on a balloon resembling in principle that described by Mr. Maccaffrey in the SCIENTIFIC AMERICAN of July 24, 1886. Mr. Brown's balloon is, however, an entirely independent invention.

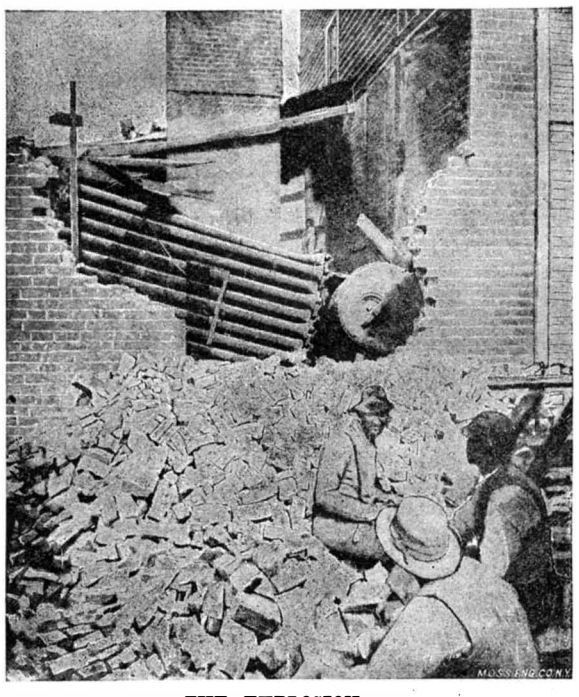
A BOILER EXPLOSION AT CHARLOTTE, N. C.

At Charlotte, N. C., on October 4, an explosion occurred in the boiler room of the cotton compress, by which the compress building was partially destroyed and the fireman, Moses White, was killed. The compress started up business for the season on Friday, October 1, after having remained idle through the summer months, and the third day's business was just being finished up when the explosion occurred.

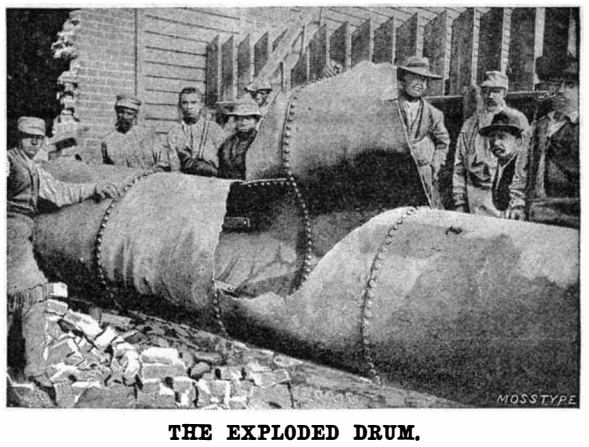


THE COMPRESS BUILDING.

The steam to operate the huge machinery of the compress was generated by Abendoff & Roots patent tubular boiler. The boiler was provided with two dry steam drums, which were located on top of the boiler. The drums were 3 feet in diameter by 8½ feet long, and it was the explosion of one of these drums that caused the mischief. At the time of the explosion the steam gauge registered only 100 pounds, and the fireman was at work trying to get the steam up to 150 pounds, the usual pressure required for the operation of the compress machinery. The force of the explosion was directly upward, the exploding drum rising straight in the air, and in falling landing within a few feet of its original position. The roof of the boiler room was blown away and the brick walls were demolished. The twin drum was blown from its position, but was uninjured. The boiler was mashed badly, but can be repaired. Our photo engravings, prepared from photos taken by Mr. J. H. Van Ness, specially for the SCIENTIFIC AMERICAN, give a view of the compress



THE EXPLOSION.



THE EXPLODED DRUM.

building, together with a sketch of the explosion and an illustration of the exploded drum, showing the extent of the rent. The iron at the opening caused by the explosion was scarcely thicker than ordinary cardboard, but the interior of the drum showed no signs of corrosion. The drum had been in use three years. Two days previous to the explosion it was subjected to a test pressure of 200 pounds, which it successfully resisted.

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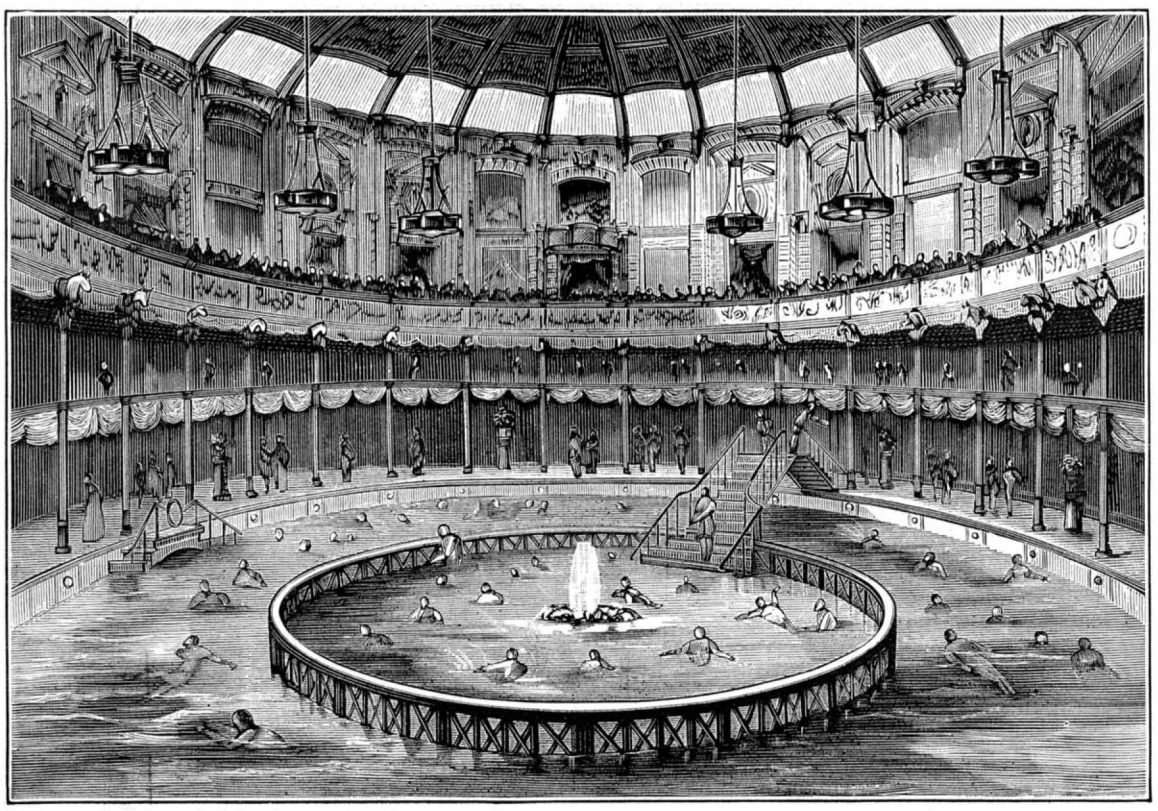
THE AQUATIC ARENA AT PARIS.

We have already given the details of the new arrangement that Mr. Oller proposed to introduce into his nautical arena in order to convert it, in summer, into a swimming bath of constant temperature. These changes have now been made, and we are thus enabled to complete the description hitherto published.

The swimming bath is formed by the central 82 foot tank, and consists of two parts of unequal depth. The flooring that supported the ring for equestrian performances has been lowered but 5 feet, and rests, as we have before said, upon hinged supports, which are themselves affixed to the posts of the metallic guard that circumscribes the ring. The intervals between the posts are occupied by an iron latticework for preventing accidents. This surface, which constitutes the shallow bath reserved for childen and persons who do not know how to swim, begins at the entrance stairway with a depth of 3 feet, and gradually slopes to the center, where the depth from there on is 5 feet. The peripheric portion forms the large bath and preserves the depth of the tank, say about 10 feet, with a width of 18¾ feet. This arrangement utilizes the surface in a more agreeable manner than a square or rectangular form would for persons who know how to swim, since it affords a longer stretch.

The bath room arrangements are very complete. On the ground floor, adjacent to the swimming baths, are located the hydrotherapic, sudatory, and massage rooms, along with the one containing the steam baths and showering apparatus of all sorts. A peculiar arrangement, as simple as it is ingenious, has been adopted by Mr. Solignac for furnishing water to the shower baths and for all other purposes. The feed system is based upon the principle of the Giffard injector, with this difference, however, that the object of condensing the steam is to produce a heating solely, and not a suction of the cold water, which enters under pressure through a conduit. The steam pipe, which terminates in a conical nozzle, enters a cylinder into which runs the extremity of the cold water conduit.

Upon properly regulating the cocks of these two pipes, one can regulate the temperature at will, so as to give either a cold shower bath or a steam bath. This system presents the advantage that but one apparatus is employed instead of two, and that there is an entire suppression of hot water piping with an elevated reservoir, and of all the annoyances and repairs that result therefrom.



GENERAL VIEW OF THE SWIMMING BATHS AT THE AQUATIC ARENA.

One of the most useful of the rooms, and one that it costs no additional fee to enter, is the lavatory, wherein bathers have every facility for cleansing themselves that is found in the hot baths. This addition, moreover, helps to preserve the water of the swimming bath in its original clean state.

The upper gallery of the old establishment is now used as a resting place, and is provided with a buffet. The stable vestibule has been converted into a gymnasium, and the stables themselves are repositories for rubbish. The water is kept at a mean temperature of 24° C. by a constant flow of water heated to 56°. We shall do nothing more than mention the mode of feeding, which permits of a complete renewal of the 42,000 cubic feet of water of the baths in two days, and at the rate of 1,750 cubic feet per hour; the freeing of the water from oily matter; the two modes of emptying the baths—one of them by means of a siphon, in which the upper, hot stratum of water forces the lower forward under the action of density, and the other by means of the feed pumps of the steam boilers; and, finally, the thorough ventilation obtained by currents of hot air, so as to prevent condensation upon the walls and ceiling. Let us state, moreover, that this ventilation has been notably increased, and carried to 210,000 cubic feet per hour, by reason of the wider evaporating surface exposed since the removal of the various tiers of seats.

The current of hot air, likewise, keeps the entire hall at a uniform temperature, so that the bather, on coming out of the water, does not experience that sensation of cold (which is often very disagreeable and even dangerous) that he does in open air bathing.—*La Nature.*

CINCHONA trees growing in hothouses in Europe develop no quinine in their bark.

Avoid Lawsuits.

An eminent lawyer informs the *Manufacturers' Gazette* that the mercantile and manufacturing communities are less given to appeals to the law now than in former years. It is a fact, he adds, that the number of such lawsuits does not increase in proportion to the increase of population. This speaks well for the good judgment of our business men. Litigation is an expensive method of settling business differences.

Seldom is either party to a great lawsuit satisfied with the result. Even to the one who obtains a favorable verdict, the long list of expenses, vexatious delays, and uncertainties, more than offsets the fruits of victory. Few men would appeal to the law in the settlement of business disputes could they realize the possible delays of the law, the exorbitant charges of attorneys and other expenses incidental to the successful prosecution of a suit.

Again, if the merchant or manufacturer would, before commencing a suit, pay a visit to the courthouse and casually examine the men of whom the juries are composed, he would hesitate to submit his grievances to such a tribunal for adjustment. In every large city there are hundreds of political strikers, hangers-on, men without legitimate employment, whose names are placed on jury lists, who have few or no qualifications for the place. The jury system, as conducted in our cities, is a failure in the consideration and settlement of complicated business matters or in the solution of difficult mechanical problems, such as frequently arise in the trial of certain cases.

With the average jury, the true merits of a case do not always control the verdict. Prejudice, a popular lawyer, an accident, a confused witness, the appearance or occupation of the parties to the suit, politics, religion, are all incidental factors in shaping a verdict in the minds of ignorant, untrained, weak-minded jurymen. Justice and equity do not always prevail in the appeal to twelve men.

Business lawsuits are too frequently born of heated passion, misunderstanding, ignorance of all the facts of the law governing the case, false pride in maintaining an opinion or a threat, an overbearing disposition, or perhaps a disinclination to look calmly at both sides of a question. There are cases in the lives of many men when a lawsuit cannot be avoided, but they are few.

Fifty per cent of all disputes could better be settled by reference to experts or those versed in matters similar to those in dispute. Many a suit would be dropped were the plaintiff able to count the cost at the commencement. Many a suit would be avoided were the parties in interest willing to weigh calmly both sides of the question, and to do unto their fellow men as they would be done by.

Think of a business man, whose time is almost invaluable to him in his regular round of duties, hanging around a courthouse day after day, awaiting the coming up of his case, witnesses under pay, costs accumulating, patience being exhausted, and all perhaps to settle the point whether his neighbor owes him $50 more or less.

An appeal to the courts of law is akin to buying a lottery ticket, though the result is not known so speedily. The victim's sufferings are longer drawn out, his money is taken in smaller but more frequent installments. A suit at law destroys a man's equilibrium, makes him nervous, irritable, ugly, prevents him from giving the needed thought and attention to his legitimate business, and generally ends in loss and disappointment. The lawsuit is seldom worth its cost, even to the one who obtains the verdict. Avoid it whenever possible to do so without prejudice to your property or character.

Sugar as an Anti-Incrustator in Steam Boilers.

The last number of the *Rivista di Artigliera e Genio* contains a brief but important article by Colonel Agostino Polto, of the Italian engineers, giving the result of certain experiments carried out by him with common sugar as a remedy for preventing incrustation in boilers. The boiler made use of by Colonel Polto was a 20 horse Field tubular boiler containing 126 tubes. This boiler was ordinarily scraped and cleaned out every forty-five days (*i. e.*, after 380 working hours), when the average weight of scale removed, after making use of the best methods known for preventing incrustation, amounted to 12 kilogrammes. Before beginning the experiments with sugar, one-third of the tubes were purposely left uncleaned. The boiler was then filled with water and 2 kilogrammes of sugar added to it; a further supply of 1 or 2 kilogrammes, alternately, being added every seven days.

After working the boiler for the usual forty-five days, it was found that it could be cleaned easily without the necessity for scraping it, and that the tubes which had been left uncleaned were considerably more free from scale than before, while the other tubes remained clean and bright. About 8 kilogrammes of old incrustations were found lying at the bottom of the boiler, having become detached by the beneficial action of the saccharine solution. A similar result was obtained after repeating the experiment for a further period of forty-five days; the tubes originally left uncleaned being in still better condition, and only 3 kilogrammes of old incrustation being found at the bottom of the boiler. The success of these experiments proved conclusively that the boiler could be used with advantage continuously for a longer period than forty-five days, and that it could then be easily cleaned by simply injecting water.

The advantages claimed by Colonel Polto for this method, if borne out by prolonged experience under varied conditions, are self-evident, and we shall be glad to hear and record the results of further trials. The sugar employed was a kind of raw sugar known in Italy by the name of muscovade, which possesses a large amount of saccharine matter. With water of medium hardness, the best results were obtained by using 10 grammes of sugar per horse power when working the boiler ten or twelve hours a day; but the exact proportion would, of course, vary under different conditions. This saccharine solution was found to have no corrosive effect on the boiler, but Colonel Polto admits that too large a proportion of saccharine, or the use of impure water, might possibly lead to corrosive action, which, however, would probably be easily obviated by adding a small quantity of soda in the proportion of one-tenth to sugar.

The Brennan Torpedo.

Some further experiments have been made at Sheerness with the Brennan torpedo, the results being described as exceedingly satisfactory. The experiments were carried on in conjunction with the electric search light at the Garrison Point Fort, and the weapon was steered about the harbor in different directions at the will of the operator in the torpedo room at the fort, and was finally directed at a target moored about a mile up the Medway, the mark being rendered discernible by means of the electric light. The torpedo is kept under control and steered by means of a wire attached to the machinery in the fort. When the experiments at the fort have concluded, it is proposed to test the adaptability of the torpedo for use as part of armament of ships of war.

Saccharine.

The authors put on record the facts that this compound traverses the organism without any alteration, and that it has an antiseptic property. Its sweetness is not similar to cane sugar, as it has been asserted. Its flavor is slightly saline and raw.—*E. Ferrand and L. Rouques, Journ. de Pharm.*

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CAPILLARY VACUA.

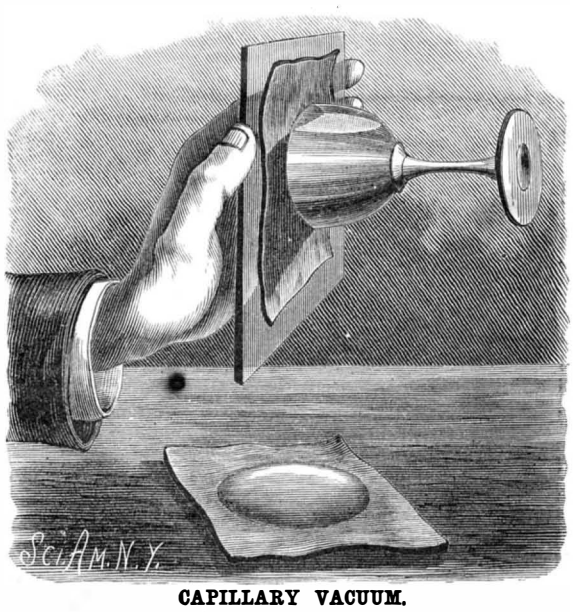
T. O'CONOR SLOANE, PH.D.

The work done by the advancing concave surfaces of columns of liquid by force of multiplication often assumes startling dimensions. The single elements producing the force are very small, and are easiest represented as tubes. If a tube of small diameter is partially immersed in water, the fluid rises within it above the level of the water in the outer vessel. This is due to capillary attraction, and is a true force. The force is exerted by the reaction between the walls of the glass tube, the air, and the downwardly curving surface of the column of fluid. The rest of the column is inert in the matter, except as it operates against and opposes the force. Capillary action is essentially surface action, and cannot exist without the co-existence of a surface. The blood in the capillaries of the extremities of the arterial and venous system is not and cannot be urged by this force, because they are completely full, proscribing the possibility of surface action. In a lamp wick the capillary work is all done at the top, the multitude of minute surfaces being maintained or renewed by the continual burning of the excess of oil.

The practical uses of this force are somewhat limited in variety. The wicks of lamps and candles present, perhaps, the most frequent source of its employment. Stones are split by the insertion of dry wooden wedges that are afterward moistened. As the water is drawn into them by capillarity, they swell up with such force as to split the stone. Towels and cloths used for drying anything work by the same force. Blotting paper absorbs the excess of ink from a freshly written page by the same film or surface action. In all these instances, the imbibing substance is essentially a series of tubes, and myriads of little concave films creeping through them draw water after themselves by atmospheric pressure, and the substance becomes wet.

Availing ourselves of the water-absorbing power of blotting paper, we may perform some very elegant experiments in capillary force with the simplest materials. Little more than a small plate of glass, a wineglass, and some pieces of blotting paper are required. Atmospheric pressure is so made to demonstrate the action of capillarity.

The wineglass is three-quarters filled with water, a piece of thick blotting paper is laid over its mouth, and over that the glass plate is placed. It is important that the mouth of the glass should be even and that the plate should be flat. Then, holding the three together in both hands, the whole is turned over so that the water comes in contact with the blotting paper. The latter immediately absorbs some of the water. Starting from the wineglass as a center, the moisture spreads outward, and the paper becomes quite wet. But in effecting this absorption a considerable amount of water is withdrawn from the glass. This creates a partial vacuum. The glass and plate adhere strongly to each other, under the effect of atmospheric pressure, so that they can be held safely in the position shown in the cut. It seems so extraordinary a thing to attempt that confidence is apt to be wanting, but after a few trials, if all conditions are complied with, it will be found infallible. The glass can be supported as shown, it can be hung downward, or it can be made to sustain the plate. To pull the plate and glass apart, considerable force will be required.

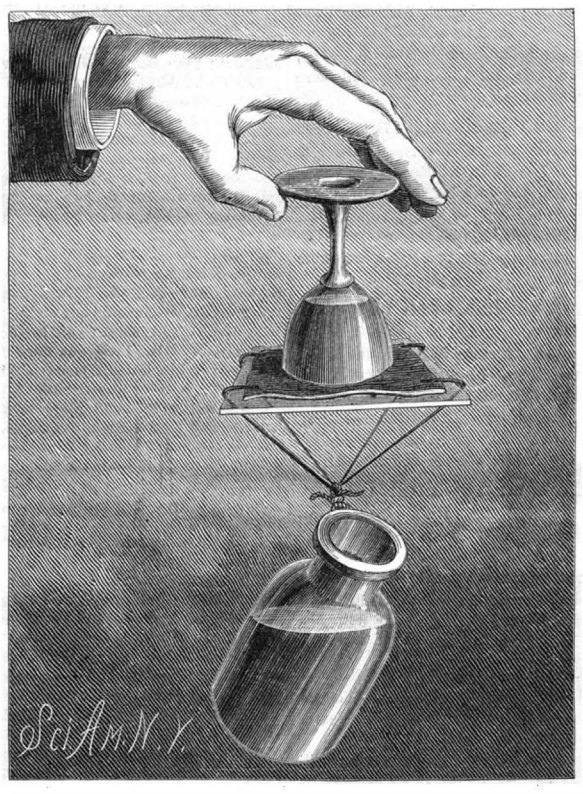


CAPILLARY VACUUM.

To obtain some idea of the force of attachment, a bottle may, by a couple of pieces of bent wire, be suspended from the plate as it adheres to the inverted wineglass. Water may now be poured into the bottle. The operation should be done over a basin in which some towels or papers are placed to break the fall in case of an accident. If the bottle is not too large for the wineglass, a weight of several pounds can thus be sustained. A wineglass one and three-quarter inches in diameter will thus support a plate, bottle, and water weighing between two and three pounds. By careful manipulation a still greater weight could probably be sustained.

It is not absolutely necessary to invert the glass to wet the paper. The glass may be filled until it begins to run over. The blotting paper is then applied to the plate, and this is quickly placed on the glass, so as to cause some of the water to overflow. The paper absorbs water and makes a vacuum as before. Under ordinary circumstances, the first is the best method of working. The latter method is employed in the next experiment, in which the vacuum is made to support a column of mercury.

A glass funnel has a glass tube fitted to its stem. This tube should be of small internal diameter, about



WEIGHT SUSTAINED BY VACUUM.

one-sixteenth inch. It dips at its bottom into a bottle of mercury. The funnel is supported in a perfectly level position. Its mouth must be very true. If not, a few minutes' grinding on a plate of glass with sand and turpentine will render it even. Water is now poured into the funnel until it is full. If the water does not run down into the tube at first, it must be forced to do so by the experimenter suddenly, and for an instant only, raising the funnel, and with it the tube, out of the mercury. Water again is added until the funnel is brimming over. The mercury, if half an inch deep, will be enough to sustain six inches of water. The lower end of the tube must be free, and not closed by resting against the bottom of the mercury bottle. The glass plate and blotting paper are now placed over the funnel. As the water is absorbed the mercury rises, until it stands an inch and a half above that in the bottle. This measures the pressure, if to it be added the height of mercury equivalent to that of the water in the tube and funnel.

The glass plate may be omitted, and a piece of blotting paper be used alone. It is placed over the mouth of a partially filled glass, the latter, with the paper held over it, is inverted, and placed upon a china plate. As the vacuum grows greater, the paper is pressed by atmospheric pressure into the wineglass, rising perhaps a quarter of an inch, like a flattened dome. After standing an hour, the wineglass is righted. If a pin or sharp knife blade is thrust through the paper, it will slightly contract, showing the stress it has been subjected to.

A piece of paper that has been thus acted on, but not perforated, and that has afterward been allowed to dry, preserves an even, cup-shaped depression, forming quite a curious object. Such a piece is shown in the first cut accompanying this article. Many other variations on these experiments will suggest themselves to those interested.

The Jute Goods Industry.

American wheat is now sent abroad packed in burlaps of Dundee manufacture. The Scotch manufacturers continue to supply us with the bulk of the burlaps used for floor oilcloth foundations, few of them being made in this country, and they control all the trade in burlaps for bags, excepting that portion of it which has been secured by the factories of India. The latter have developed of recent years into formidable competitors with the Scotch manufacturers, and it is possible that a few years from now most of the jute goods consumed in Europe will be manufactured in the East Indian factories.

For several years there has been held before the eyes of ambitious inventors an offer of a prize of $10,000 for the first ten bales of jute grown and prepared for market in the United States at a cost which will admit of successful competition with the Indian article, but the prize is still unearned.

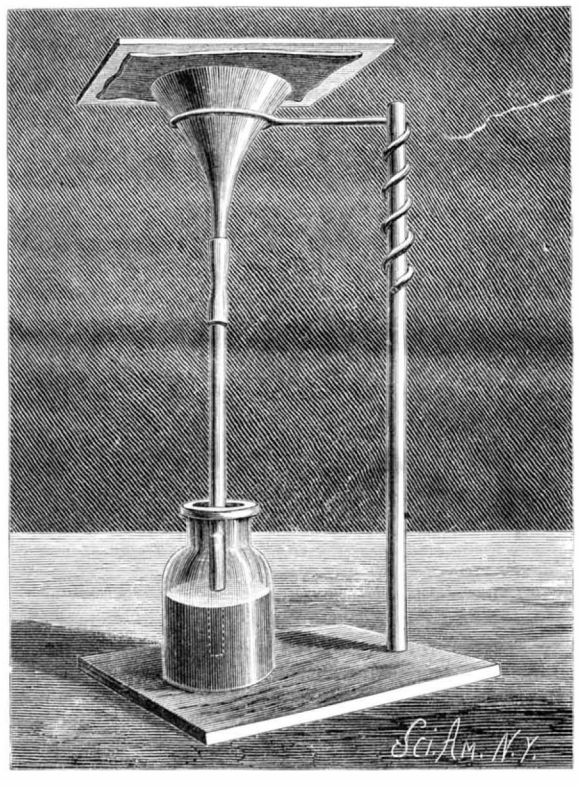
The principal and apparently insurmountable obstacle which confronts all efforts in this direction is the lack of a machine which will prepare the jute fiber for the market at a cost low enough to offset the cheap hand labor of India. In the jute plant, the fiber lies between the pith and the bark. It is necessary to remove the latter and separate the jute from the pith, and this must be done without injuring a fiber which is one of the most delicate known. In India, the natives who do this work are paid from seven to ten cents a day; and if a machine could be devised which would perform the task as perfectly as it is done by Indian fingers, the immense difference between the cost of labor here and in India would continue to be a potent factor in favor of the Indian in this as in other stages of the work to be done before the fiber was ready to enter the factory. Machinery may assist the American manufacturer in his struggle with European competition, but in India flesh and blood are even cheaper than iron and steam.

In view of these facts, it would seem the manifest duty of our government to open the way as far as possible to a cheap and sufficient supply of the raw jute required by our own manufacturers of jute goods, but instead of doing this our legislators have imposed a duty of 20 per cent on the raw jute, thus discriminating against a native industry which is already at enough disadvantage without this additional and uncalled for burden.

If raw jute were placed on the free list, it is probable that the jute fabrics now imported into this country under the head of burlaps and like manufactures of jute, to the amount of about $12,000,000 annually, would all be made in the United States. The removal of the duty would also give a much needed impetus to the jute carpet manufacture by enabling the manufacturers to reduce the prices of carpeting, and so broaden the demand for it by bringing it within the reach of many who are now obliged to dispense with floor coverings, while the present consumers would be stimulated by its cheapness to a more liberal use of it.

These facts have been repeatedly brought to the attention of our legislators at Washington, but so far without the slightest effect; and while such indifference continues to characterize our tariff makers in this respect, there is no promise of any material improvement in the present condition of the jute goods industry.

The export of jute from India amounts now to about 3,000,000 bales annually, and of this quantity not more than 60,000 bales come to the United States in the raw state, and yet this country consumes in various ways one-third of the entire jute crop of India. There is imported annually sufficient manufactured jute cloth to make the 130,000,000 bags used in moving our crops of wheat, oats, corn, flour, and other farm and manufactured products. With free raw jute all this cloth could be made here, to say nothing of the



MERCURY COLUMN SUSTAINED BY VACUUM.

thousand and one other uses which would doubtless be found for the jute fiber, if, as has been said, a cheap and abundant supply of it were at hand.—*Carpet Trade Review.*

ALL sediment cocks in kitchen boilers should be left open at least once a week for the space of fifteen minutes, so as to clean and wash out all foul sediment. Oftentimes when complaint is made that the water smells, or that it don't heat properly, the real cause will be found to arise from this neglect alone.

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ENGINEERING INVENTIONS.

A frogless switch has been patented by Mr. Abraham Culp, of Mount Carmel, Pa. It is so made that the strain incident to the shifting of the switching rail is distributed throughout the length of the rail, instead of falling, as usual, upon one point, and thereby causing a bending of the rail.

A combined steel tie, rail fastening, and lock joint has been patented by Messrs. Theodore L. Mumford and Hugh Moore, of Mauch Chunk, Pa. Combined with a tie having stationary jaws and apertures, and the rails, are lever clamps inserted in the apertures, and held on the rail flanges by nuts, holding the rails securely in place, and permitting the making of the middle parts of the ties narrower than the end parts.

A railway signal has been patented by Mr. Pierson J. Wicks, of Greenpoint, N. Y. It consists of a contact wheel attached to the locomotive, an alarm in the cab electrically connected with the tires of the contact wheel, and a switch between the electrical connections of the alarm and the contact wheel, with other novel features, for automatically sounding a bell in the cab of a locomotive as soon as two or more trains are on adjoining sections or at a crossing.

A railroad rail joint has been patented by Mr. Thomas A. Davies, of New York city. This invention provides rail joints constructed in such manner that the amount of bearing surface in contact will be unaffected by the setting up of the fish plates, the upper bearing surfaces of which will always rest tightly against the corresponding bearing surfaces of the rail.

A fish plate for railroad rails has likewise been patented by the same inventor. Fish plates are to be made, by this invention, with flanges upon their lower edges projecting outward farther than the base flanges of railroad rails, with recesses in their outer edges to receive the heads of the fastening spikes driven into the ties at the outer edges of the base flanges of the rails, the object of the invention being to provide fish plates that will hold the rails from longitudinal movement without interfering with their proper effect as fish plates.

AGRICULTURAL INVENTIONS.

A combined harrow and cultivator has been patented by Mr. David Kessler, of Willis, Kan. This invention covers a combination of various novel features in a machine that can be readily adjusted for cultivating listed corn or surface corn, or for ordinary harrowing, and which shall be reliable and effective with either adjustment.

A horse hay rake has been patented by Mr. George K. Schauer, of Osborn, O. A frame carrying roller is fixed on one wheel of the axle, and a lever is pivoted on a fixed piece on the axle, and has a cam projection, with operating mechanism, whereby the cam is thrown into and out of the path of the rollers, to facilitate the reversing of the rake for discharging grass, etc.

A planter has been patented by Mr. William Lewis, of Dawn, Mo. Its construction is such that the main frame of the machine and the parts carried thereby may be raised above the normal position when the machine is to be taken from one place to another or turned at the end of a row, which is done by hinging the main frame to arms rigidly connected to and extending to the rear from the axle of the planter.

MISCELLANEOUS INVENTIONS.

A candle attachment has been patented by Mr. George Whyte, of Northview, Elgin, Scotland. It consists of a dome-shaped cap, with weight-casing, standards for supporting a shade, and other novel features, the device preventing the overflow of melted grease, as well as making a shade holder.

An insecticide has been patented by Mrs. Rebecca McKee, of New York city. The composition embraces a number of materials easily obtained of any druggist, and which can be readily mixed and prepared for use in places infected with insects or vermin, as a thorough and efficient destroyer of such pests.

A uterine supporter has been patented by Mrs. Martha F. Haynes, of Athol Center, Mass. It is a device for affording relief and promoting cure in cases of prolapsus uteri or reversions, it being simple and inexpensive in character, and which may be easily adjusted by the patient and worn without discomfort.

A sash lock has been patented by Mr. Charles E. Nicholas, of Toledo, Ohio. A tongue with a spur and notch is pivoted in a casing in such way that it can be attached to the stile of the upper sash of a window, for engagement with the top rail of the lower sash, to make a simple and efficient sash lock without the use of springs.

A turntable for hay carriers has been patented by Mr. Edwin Woodward, of Stryker, O. It is constructed in such a manner that with it an ordinary hay carrier can be readily reversed, when it is desired to deposit the hay or grain in the other end of the barn, the device being simple to make and reliable in operation.

A fireproof shutter for stairways has been patented by Mr. Henry Dale, of New York city. It is made of corrugated iron, and housed or boxed beneath the stairs, so that it can be readily withdrawn from its housing and drawn to a position to cover the well or opening formed for the stairway leading to the floor beneath.

A paint has been patented by Mr. John H. Palmer, of West New Brighton, N. Y. It is made by combining the residuum of linseed oil, resulting from purification, with a certain amount of linseed oil, the matter remaining after the usual process for purifying oil from flaxseed having heretofore been generally a waste material.

A spring roller has been patented by Mr. Charles E. Brooks of Brooklyn, N. Y. It is a window shade roller, made in such manner that the revolution of the roller will be stopped automatically when the shade has been rolled up to a fixed limit, to prevent disarrangement or breakage of the roller or its fixtures, should the roller be accidentally released.

A photographic camera has been patented by Mr. John S. Johnston, of New York city. It is a plate reservoir camera, in which the sensitive plates are automatically fed up in succession, and after receiving their impressions are automatically deposited in a receiving reservoir, especially adapted for use for detective and instantaneous photographic purposes.

A tube expander has been patented by Messrs. William Schoendelen, William Klein, and August Schoendelen, of Davenport, Iowa. This invention provides a simple and easily operated hand tool for expanding bushes in the bung holes of barrels and kegs, to retain the bushes in their place, and to tighten them should they become leaky after use.

A freight handling mechanism has been patented by Mr. Drew Stretch, of Liverpool, Eng. It embraces a boom jointed to swing vertically and laterally, a pulley wheel and devices for its longitudinal adjustment on the boom, a hoisting rope, guy ropes, etc., to facilitate the vertical raising and lowering of the freight, and to bring the freight into position to be dumped into the chutes.

A filling apparatus has been patented by Mr. Thomas H. Hathaway, of New Bedford, Mass. The bottom of a receptacle for holding a liquid has a movable plate in connection with a series of apertures and funnels, so arranged that when a number of bottles of the same size are placed beneath the funnels, they may all be filled at the same time, by the moving of an arm by which the apertures are opened and closed.

A harness has been patented by Mr. John H. Whitaker, of Davenport, Iowa. This invention relates to a former patented invention of the same inventor, of harness for training horses, and covers an improvement whereby the bearing surfaces of lines extending beneath the horse's belly and between his hind legs have but a slight movement along with the horse's leg without rasping it.

A bicycle shoe has been patented by Mr. Thomas J. Strickland, of Randolph, Mass. The insole has an intermediate or shank portion of greater flexibility than the end portions, and the outer sole is composed of an inner and an outer layer of greater flexibility than the inner layer, making the shoes more flexible and better adapted to resist the jar or vibration of the machine.

A printing plate holder has been patented by Mr. Marshall J. Hughes, of Jersey City, N. J. This invention covers clamping plates with opposite edges bent or angled to form lips to embrace the beveled edges of stereotype or other printing plates, one of the bent lips having an adjusting screw, and the clamping plates being held by the furniture employed by locking the block in the chase.

A necktie fastener has been patented by Mr. Frederick Standish, of Shelton, Conn. It consists of a clasp held to the tie and having opposite yielding hooks, with a stud having holes to which the clasp hooks are adapted, making a simple and inexpensive device which will allow the necktie to be put on and removed very quickly and conveniently, and will hold it securely in its place when adjusted.

A calf weaner has been patented by Mr. William H. Tyler, of David City, Neb. It consists of a wire frame with loops adapted to be received in the nose of the animal, the combination with a metallic apron arranged to hang over the mouth, the wire frame having two projecting points for preventing the apron from being thrown over the nose, the device being also serviceable for keeping cows from sucking themselves.

A calf weaner has been patented by Mr. Cyrus J. Fox, of Falls City, Neb. This improvement is embodied in a rubber headstall which is capable of adjustment in size, and a series of pendent bars, adapted for attachment to the animal's head, but so as to offer no obstruction in feeding on grass or out of a trough, as the muzzle will slide readily up the head when it rests down against anything.

A neck yoke coupling has been patented by Mr. Jacob B. Lowman, of Virginia City, Montana Ter. It is for attachment to a vehicle pole or tongue, and is so made that with it neck yokes having a ring of any size may be connected securely to the pole or tongue of a vehicle, and as the horses hold back the ring will draw, so as to have less tendency to bend or break the pole than when other couplings are used.

A packer for oil wells has been patented by Mr. John D. Brooder, of Kane, Pa. It consists of a conical expander placed between two rubber packing rings, with a device for forcing the rubber packing rings upon the conical expander, the packer to be secured to the lower end of the tubing of the well, and lowered with the tubing in an unexpanded condition, and when in place the pipe to be turned to force rings on the expander and cause the elastic rings to entirely fill the well.

The making of gelatine printing rolls, and making matrices therefor, form the subject of two patents issued to Mr. Edwin P. Benjamin, of Minetto, N. Y. The rolls are for use in printing continuous patterns upon cloth, paper, or other substance, of any desired length, and are moulded in gelatine on a flexible sheet, to form a plate thereon, the sheet being then drawn tightly around a tubular shell or core until the edges of the plate are brought together and connected, the core being of especial design to adapt it for such work. The matrices used in casting the patterns in the gelatine are made of gutta percha, into which plumbago has been well worked, pressed in thin sheets between heated metallic plates, upon the face of one of which is the desired pattern, the gutta percha plate thus formed being heated until it becomes sufficiently pliable to be bent in the form of a hollow cylinder, the patents likewise covering numerous practical details intended to facilitate the making of rolls for printing continuous patterns.

Special.

A NEW PHASE OF DARWINISM.

A DEVELOPMENT OF HEREDITY; THE POWER OF FAITH; A SEARCH FOR PURITY; A REGENERATION OF BLOOD; THE SAVING POWER OF PURITY.

Erasmus Darwin, the man of science, the poet, and the good physician, came to Lichfield, Staffordshire, England, fresh from the University of Edinburgh, about the year 1760, when he was not thirty years of age. He took a humble suite of rooms on a street that overlooked the silvery Trent, and at once entered upon practice, which in a remarkably short time became extensive and lucrative. With professional popularity he gained social distinction among the young people of the town. In the shadow of the noble Cathedral he found friendship and association such as had been denied the other great Lichfield man, Samuel Johnson, and such as had been given Lichfieldians like Gilbert Walmsley and Henry Hervey. There were young ladies of rank and wealth who smiled on him, and were willing to give their money and titles in exchange for his love, but he cared not. Marriage was far from his thoughts. His profession was his all. He had no time for love or pleasure.

In 1768 he was called upon one day by Thomas Chaffee, a wealthy brewer, who complained of a severe pain in his stomach. The doctor had been doing a great deal to stay the tide of intemperance that was cursing the borough, but his words had not weighed against the product of Chaffee's malt. Now a chance for an effective temperance lecture was at hand.

"Thomas," he said, "you have got a cancer. Your liquor caused it. I cannot cure you. You have committed suicide, but for God's sake stop your brewing before you commit unnumbered homicides."

Quite naturally, such plain language displeased the brewer, and he went home enraged. His daughter Sinai shared her father's anger when she heard of the young doctor's words, and having a wild spirit of her own, she forthwith called on Dr. Darwin to show her resentment. The outcome of the call was that the lady admired the physician's quiet courage of conviction, and he reciprocated by admiring her championship of her father and his vocation.

The result was mutual love and a marriage engagement. In a few months Thomas Chaffee was dead of gastric cancer, and his daughter had shown her love for Dr. Darwin by selling the brewery, and by working hand in hand with him to diminish drunkenness. She would do anything for him, and she loved him with most beautiful strength and depth of affection.

But the doctor was too scientific to be a true lover. He was too much like his grandson. The girl pleased him well, but after a protracted engagement he heartlessly broke it by arguing to himself and his fiancee that it was probable that she would inherit her father's terrible malady, and that such a probability would entail a burden of unhappiness on them both. Such cool reasoning was a dreadful blow to the orphan girl, and as nothing was left to bind her to her native town, she soon emigrated to America. Dr. Darwin removed from Lichfield to Derby, a little later, and won great fame as an author and a scientist, and had a home that might have been happy.

Sinai Chaffee could not forget her first love. Finding a home with relatives near Albany, she lived a quiet maiden life for many years, and never entered society. Amasa Converse went frequently from his home in Windsor, Mass., to Albany, and when the next June came up the Hudson, there was a bloom of orange blossoms at the Van Ness mansion house, and Chancellor John Lansing gave away the bride, the fair and gentle Sinai. Mr. Converse was a farmer, but he gave his wife a pleasant home among the Berkshire hills. When her first born came, and they told her it was a son, she said, "His name shall be Erasmus Darwin Converse."

The years passed happily. Afterward there were born two daughters, and then the mother died. On her dying bed she told her sister-in-law of her early love.

"There is no cancer in my blood," she said, when the fury of fever had inflamed her veins; "but, Polly, I fear that my boy may some time suffer from the disease."

Polly only smiled at such an idea, but she did not forget it. Darwin Converse grew a stalwart and healthy lad, but he had his mother's gentle and retiring manner. His father married again and sent the boy away to school, where for a chum he had George Dana Eustis, and where he made the close acquaintance of William Cullen Bryant. The poet was soon away to the city, but he left young Converse in Cummington, where for a quarter of century they met every summer and kept their friendship warm. Converse was a farmer, but he was a scholar and a philosopher, and his secluded life was never other than happy. Marrying a wife, and a successful life, he passed middle age and never knew a day of sickness. One autumn day in 1873 he drove from Cummington to Pittsfield, and, as was his custom, took dinner with his aunt, Mrs. Polly Pratt.

"Why do you wear a muffler," she asked him.

"My throat pains me some," he said, "and so I bundle it up."

The old lady asked to see his ailing throat, and noticed on one of the tonsils a small scarletspot.

"Can it be—cancer?" she thought, remembering his mother's prophetic fears.

The next time the father went to Pittsfield it was three months later, and it was to consult a physician about his throat. Dr. C. D. Mills examined him, and finding his system in prime condition, was inclined to treat him for an entirely local affection.

"Doctor," said the sage old aunt, "isn't it cancer?" and she told of the hereditary liability.

The next time that the doctor looked at the circumscribed, angry redness, he recognized the antecedent heredity, and knew the particular direction that the morbid action had taken. "Cancer," he said; and in his opinion coincided Dr. William Warren Greene, Dr. Thomas Hun, Dr. A. N. Allen, and several other eminent surgeons. It was cancer, at the best terrible, but in this case made more terrible by its inaccessibility.

The prophecy, born of outraged love, was fulfilled; and while Charles Darwin was surprising the world with his brilliant theories, the son of his grandfather's wronged first love was feeling deathly pain as he breathed the keen Massachusetts air.

One day, as the farmer read his paper, he chanced to see an item which told of a Philadelphia physician who was treating diseases with a compound form of oxygen. The farmer liked the idea, and in the summer he went to Philadelphia. Dreading lest he was to fall into the hands of a charlatan, he gave Dr. G. R. Starkey an assumed name, and showed him his throat. After an examination he said, "Doctor, if your treatment will purify my blood, I want it." "The inhalation," answered the physician, "will do just this if you will give it time. It will render your system able to throw off the matter that causes the disease." "I am a believer. Begin your treatment," was all the man could say.

Advantages were realized at once. The system that had began to totter under the burden of the terrible disease was speedily vitalized, and gradually the throat lesion began to assume the appearance of healthy healing. "*My throat is well*," he was soon able to say, and with the exception of a cicatricial spot in place of the ulcer, he never suffered further inconvenience. Of course the physicians had to admit that he was *cured*, though Dr. Mills was inclined to doubt.

Alonzo Morse, a worthy citizen of Vineland, N. J., was a cousin of Mr. Converse, and had a cancer at the inner canthus of his left eye. He was induced to try the Treatment, and was cured, as hundreds of reputable citizens of Vineland, and Dalton, Mass., can testify. Said Mr. Morse to a reporter, "That Philadelphia doctor saved my life, and I am positive that there is no other physician who can cure cancer."

This is but one of a hundred singular, chronic cases whose relief and final cure has made their friends view it as almost a miracle.

The above testimonial is published—not to claim for the Compound Oxygen a cure of any specified disease, but, as a marked illustration of the way it cures all afflictions. The process is that of *revitalizing* the physical organism, so that it is restored to a state of natural health. Now, it is to be well noted that this revitalization is not an artificial supply of a given amount of vitality, which is to be soon exhausted, thus leaving the system in the same condition in which it was; but it puts the organs whose functions it is to generate vitality, in a state of full health. This testimony was written by the well known writer, "Rev. M. C. Cogswell," without our suggestion or knowledge, and sent to us. We have kept it two years, and have taken pains to establish its authenticity. Being satisfied on that point, we allow it to go forth, not for the purpose of soliciting cases of cancer for treatment. We have never *seen* a case of cancer thoroughly cured by Compound Oxygen, but we have seen enough of its effects in cancerous cases to be convinced that many of them might be cured if taken in time.

In corroboration of this statement we give the following account of a case sent to us by the patient, an estimable lady of Millersburg, Ohio:

"August 31, 1886.

"I think you have said in some of your circulars that you did not claim that the Compound Oxygen would 'perform surgical operations or cure cancer.' I think I can now say that it has cured what would have been a cancer two years ago had it not been treated according to your directions. While using the Oxygen by inhalation, I also bathed the sore, or rather covered it with a cloth saturated with inhaler water, at morning and at night, as directed, since it became worse through neglect of the treatment last spring, and am happy to say that I regard it as cured, although I still apply the water. The itching and gnawing sensation is gone, the last vestige of scab has disappeared and there is only a small discolored depression (very slight) left to tell of the trouble now. I have used nothing for it whatever except your treatment, so the cure can be ascribed to nothing else.

The Compound Oxygen has now received a world-wide reputation for efficiency in curing chronic diseases. The afflicted will find facts and testimonials greatly to their interest in the Treatise on Compound Oxygen, and their publications on various diseases, which are all sent free upon application. addressed to Drs. Starkey & Palen, No. 1529 Arch Street, Philadelphia, Pa.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Metallic Pattern Letters and Figures to put on patterns of castings. Knight & Son, Seneca Falls, N. Y.

"*Great Oaks from Little Acorns Grow*," and great benefits ensue from the use of Dr. Pierce's "Pleasant Purgative Pellets"—tiny, sugar-coated granules—which obviate the necessity of choking and "gagging" in the attempt to swallow some huge bolus of uninviting aspect and disagreeable effect. Their cathartic action is thorough, yet perfectly gentle, and unlike other pills, they never react toward constipation. In cases of sick headache, and as a promoter of digestion, they are unsurpassed. By druggists.

Send for free Catalogue of Books of Amusements, Speakers, Dialogues, Card Games, Fortune Tellers, Dream Books, Debates, Letter Writers, Etiquette, etc. Dick & Fitzgerald, 18 Ann St., New York.

Wanted—The general agency for a good novelty. G. R. R. 3633 North St., Philadelphia.

Method for improving draught of steam boilers, etc. Circulars. T. Sharts, 184 E. 93d St., New York.

Machinist Foreman wanted who can handle fifty men to advantage and increase their production by latest improved ways of doing work. Address P., care of Wilkinson & Co., 352 Atlantic Ave., Boston, Mass.

Friction Clutches from $2.25 on. J. C. Blevney, Newark, N. J.

Second-hand Tools For Sale by Poole & Hunt, Baltimore, Md.—One planing machine, will plane 35″ wide, 27″ high, and 16′ 6″ long; one planing machine, will plane 30″ wide, 26′ high, and 5′ 6′ long; one planing machine, will plane 24′ wide, 20″ high, and 5 feet long; one double geared chasing lathe, will swing 24″ dia., 8′ 6″ long; one drill grinding machine; one small punching and shearing machine, with flywheel and clutch starting arrangement.

Haswell's Engineer's Pocket-Book. By Charles H. Haswell, Civil, Marine, and Mechanical Engineer. Giving Tables, Rules, and Formulas pertaining to Mechanics, Mathematics, and Physics, Architecture, Masonry, Steam Vessels, Mills, Limes, Mortars, Cements, etc. 900 pages, leather, pocket-book form, $4.00. For sale by Munn & Co., 361 Broadway, New York.

Woodworking Machinery of all kinds. The Bentel & Margedant Co., 116 Fourth St., Hamilton, O.

Foreman for machine tool department of a large stationary and portable engine works. Must be a draughtsman and familiar with valve movements and high speed automatic engine work; must understand handling men. To the right person there is an opportunity to secure the position of superintendent of the establishment. Address, stating age, T. E. J., P. O. box 773, New York.

Engines and boilers, ½ to 4 H. P. Washburn Engine Co., Medina, O.

A Catechism on the Locomotive. By M. N. Forney. With 19 plates, 227 engravings, and 600 pages. $2.50. Sent on receipt of the price by Munn & Co, 361 Broadway, New York.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Pumps for liquids, air, and gases. New catalogue now ready.

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The Knowles Steam Pump Works, 44 Washington St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Concrete Apparatus, etc. Ernest Ransome, S. F., Cal.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. $100 "*Little Wonder.*" A perfect Electro Plating Machine. Sole manufacturers of the new Dip Lacquer Kristaline. Complete outfit for plating, etc. Hanson, Van Winkle & Co., Newark, N. J., and 92 and 94 Liberty St., New York.

Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

Send for catalogue of Scientific Books for sale by Munn & Co., 361 Broadway, N. Y. Free on application.

Timber Gaining Machine. All kinds Wood Working Machinery. C. B. Rogers & Co., Norwich, Conn.

Iron, Steel, and Copper Drop Forgings of every description. Billings & Spencer Co., Hartford, Conn.

Rubber Belting, all sizes, 77½ per cent regular list. All kinds of Rubber Goods at low prices. John W. Buckley, 156 South Street, New York.

We are sole manufacturers of the Fibrous Asbestos Removable Pipe and Boiler Coverings. We make pure asbestos goods of all kinds. The Chalmers-Spence Co., 419 East 8th Street, New York.

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Curtis Pressure Regulator and Steam Trap. See p. 142.

Cushman's Chucks can be found in stock in all large cities. Send for catalogue. Cushman Chuck Co., Hartford, Conn.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

60,000 *Emerson's* 1886 ☞ Book of superior saws, with Supplement, sent free to all Sawyers and Lumbermen. Address Emerson, Smith & Co., Limited, Beaver Falls, Pa., U. S. A.

Wrinkles and Recipes. Compiled from the SCIENTIFIC AMERICAN. A collection of practical suggestions, processes, and directions, for the Mechanic, Engineer, Farmer, and Housekeeper. With a Color Tempering Scale, and numerous wood engravings. Revised by Prof. Thurston and Vander Weyde, and Engineers Buel and Rose. 12mo, cloth, $2.00. For sale by Munn & Co., 361 Broadway, New York.

Hoisting Engines. D. Frisbie & Co., New York city.

Equatorial Mountings, Reflecting Telescopes, etc. Reasonable prices. Gardam & Sons, 96 John St., N. Y.

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Stewart's Anti-Incrustation Solution. See next issue.

Iron and Steel Wire, Wire Rope, Wire Rope Tramways. Trenton Iron Company, Trenton, N. J.

Astronomical Telescopes, from 6″ to largest size. Observatory Domes, all sizes. Warner & Swasey, Cleveland, O.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) M. R. T. asks (1) a recipe for black paint for iron smokestacks. A. Use coal tar if it can be had; next, lampblack and boiled linseed oil, or plumbago paint. 2. For preventing boiler scale. A. We recommend a study of Davis book on boiler incrustation. It treats of various kinds of water and scale. We can furnish it for $2.00. 3. What causes the roaring or humming noise produced by acoustic telephones, and why is it at intervals instead of being constant? A. The humming noise of the telephone is mostly caused by wind, or an induction from some other source of noise.

(2) F. C. asks (1) for a receipt for making an indelible marking ink using aniline black as coloring matter. A. An indelible aniline ink may be made thus: One hundred gr. of hydrochlorate of aniline and sixty gr. of chlorate of sodium are dissolved in three and a half ounces of water, and a half grain of vanadate of ammonia added to the liquid, when it will soon become dark colored, and deposit an abundant precipitate of aniline black. This may be dried, made into a paste with powdered gum arabic water, and glycerine, and used with a stencil. 2. A good receipt to make inks for stylographic pen. A. Use simple solutions of nigrosine or aniline black in water.

(3) C. M. asks: What are the chemicals used, or the process necessary, in order to repair articles made from tortoise shell? A. Use the following cement: Mastic thirty parts, shellac ninety parts, turpentine six parts, spirit of wine ninety per cent strong, three hundred and fifty parts.

(4) C. S. M. asks how to prepare a polish (or dressing) for furniture, whereby old furniture may be made to assume a bright and new appearance. A. Melt three or four pieces of sandarac, each of the size of a walnut, add one pint of boiled oil, and boil together for one hour. While cooling add one drachm of Venice turpentine, and if too thick a little oil of turpentine also. Apply this, and after some hours rub off. Make frequent applications.

(5) A. H. C. asks how to make a hard transparent soap. A. It is made by dissolving hard white soap, previously reduced to meal and thoroughly dried, in alcohol. A steam bath, fitted with a still-head, makes a good containing vessel. The alcohol and soap are taken in about equal proportions; and as the solution proceeds, any spirit which may distill over must be allowed to condense in a worm and be collected in a receiver. The heat should not exceed 212°. After solution, allow time for settling. Then draw off the clear fluid from the sediment into wooden frames or globular moulds, after which color and perfume the same as other soaps.

(6) A. E. H. asks: What is the best material for polishing brass, especially hot brass? A. Mix together 1 ounce oxalic acid, 6 ounces rottenstone, and a half ounce gum arabic; all these are to be finely powdered. Then add one ounce sweet oil and sufficient water to form the mixture into a paste. Apply a small portion to the article to be cleaned, and rub dry with a flannel or wash leather. See "Spons' Workshop Receipts," second series, which we can send you for two dollars.

(7) E. M. R. wants a No. 1 cement for cementing hot air furnace and stoves. A. The following cement, used for steam pipes, will probably be found satisfactory: Litharge 2 parts, powdered slaked lime 1 part, sand 1 part. Mix the mass with a sufficient quantity of hot linseed oil varnish to form a stiff paste. This cement must be used while fresh and warm.

(8) J. & B. ask for a receipt to make a good stove polish which can be moulded into bars. A. It is made from graphite or black lead purified in the usual manner, and then mixing the powder with some oil of turpentine, to which some ordinary turpentine has been added to make it adhesive, after which the whole is subjected to strong pressure in appropriate moulds.

(9) J. K. asks how to get out the white stain which alcohol makes on varnish, without painting it over. I am informed there is a preparation which you need only to rub over it to take the stain out and polish it at the same time. A. As the alcohol dissolves the varnish, the spot cannot be removed, except by renewing the varnish. The article to which you refer is probably some simple alcoholic solution of shellac.

(10) W. C. P. asks for a mineral that, when moistened, will ignite, and that can be worked into very small lozenge-like pieces. A. The article referred to may be the metal potassium or phosphide of calcium; as they are all dangerous, we would not recommend their use.

(11) J. G. M. asks if there are any chemicals that will destroy lampblack. A. Boiling solution of chromic acid in sulphuric acid or boiling nitric acid. These are to be handled with care.

(12) D. B. K. asks how to oxidize brass and German silver ferrules. Would like to give them a dark appearance without being shining or polished. A. You may oxidize brass or German silver by a vapor bath of sulphur made by burning a small piece of sulphur in a box in which the ferrules are hung. Another method is to dip the ferrules in a solution of water and a few drops of hydrosulphate of ammonia heated to about 180° Fah. The strength must be found by trial.

(13) A. B. asks (1) how to make a composition to resilver brass. A. Prepare a solution of 1 part cyanide of potassium in 6 parts water; add to it a concentrated aqueous solution of nitrate of silver (free from acid) until the precipitate is redissolved. Mix this solution with fine chalk, and apply after previous cleaning of the objects. 2. And also how to silverize iron. A. Unless the iron is first coated with copper, the process is somewhat difficult. See the receipts given for this purpose in the "Techno-Chemical Receipt Book," which we can send you for $2.00.

(14) E. A. M. asks the best lubricating oil to use on very light machinery, such as dental engines and lathes. Sperm, lard oil and kerosene all gum up in time. A. There is no oil that will not gum in time. Use good sperm oil that has been treated with lead shavings and exposed to the sun in a bottle for a few days. Decant the clear oil. The lead and sunlight will purify the oil.

(15) G. F. asks a way to color castings of Babbitt metal or type metal so as to give them the appearance of gray iron that has been coppered. A. The castings can be colored by a deposition of a thin film of copper by dipping in a solution of sulphate of copper and water.

(16) B. C. H.—Low temperature thermometers are made with colored alcohol, which is liquid at about as low as 160° Fah.

(17) T. V. L. F.—The pressure that lead or any other soft metal or alloy will stand depends upon the relative proportions of the thickness of the walls and the interior area of a cylinder. None of the soft metals is fit for a steam cylinder for an engine, if that is what you mean. Use iron or hard brass. Use the ordinary yellow brass for hard soldering or brazing copper.

(18) C. S. R.—Coke at 8 cents per bushel has nearly the same value in carbon as anthracite at $4.50 per 2,000, lb., but is not as good for firing under small boilers. It is light and spongy, occupying nearly twice the space of anthracite, and requires more attention to keep up the intensity of fire required in boilers constructed for anthracite fires. With fire chambers of larger dimensions, coke is nearly equal to anthracite for equal weights.

(19) J. S. W. asks (1) why a cutter yacht carries a shifting bowsprit. A. For convenience of housing in rough weather. 2. Why is the cutter or sloop rig faster than the schooner rig? A. With the same area of sail, the single sail is supposed to hold the wind better than when divided.

(20) P. A. F. writes: In plating small articles with tin, I find that the metal becomes foul and makes the work rough. How shall I remedy this? Would it be advisable to mix antimony with the tin? A. You can improve the tin bath by thoroughly stirring with a stick of green wood, which boils the tin by liberating steam and gas, then cool until it will just pour, when you can pour off the tin slowly, leaving the alloys in the pot. You may use a little sal ammoniac (pulverized) on the tin surface to clear it, and occasionally skim off the dross. You will not be able to use up all the tin of the bath in tinning. It does not pay. Better sell it or make it into coarse solder. Use no antimony.

(21) T. S. asks the process by which quicksilver is applied to glass to make a mirror? What coating can be applied to the quicksilver to protect it from dampness or moisture? A. The quicksilvering of glass is done by covering a sheet of pure tin foil laid upon a cushioned table with mercury; then, sliding the clean glass on the mercury to prevent air bubbles, and pressing the glass down upon the foil, slightly tip up the table to allow the surplus of mercury to run off. Leave the glass under pressure for several hours, to allow the amalgam to set. You cannot put anything on the back to protect it. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 105, for the wet process, which allows of lacquering the back.

TO INVENTORS.

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INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted,

October 12, 1886,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Air with natural gas, apparatus for mixing atmospheric, W. Snee ... 350,849
Alarm. See Fire alarm.
Armatures, machine for winding, L. B. Jones ... 350,828
Ash pan, S. J. Byers ... 350,866
Aspirator, etc., surgical, A. E. A. Ruault ... 350,895
Atomizer, C. H. Fisher ... 350,822
Auger, S. Burd ... 350,657
Auger handle, W. H. F. Raifsnyder ... 350,841
Awning frame, Toulouse & Delorieux ... 350,902
Axle box, car, J. Timms ... 350,852
Axle lubricator, carriage, J. Sladdin ... 350,780
Bag or satchel frame, W. Romer ... 350,641
Baking or firing compounds of plastic material, etc., process of and apparatus for, Stewart & Hastings ... 350,567
Balusters, machine for dovetailing, B. F. T. Bell ... 350,575
Banjo, F. R. Mustill ... 350,698
Bar. See Window shade bar.
Barrels, machine for cutting head linings for, L. Reed ... 350,697
Bathing apparatus, J. W. James ... 350,490
Bathing machine, J. W. James ... 350,489
Battery cell, galvanic, L. Drescher ... 350,621
Bench. See Work bench.
Bicycle, C. E. Duryea ... 350,583
Bicycles, saddle spring for, L. S. Copper ... 350,866
Blast ovens, cleaning apparatus for hot, V. O. Strobel ... 350,569
Blast ovens, valve for hot, V. O. Strobel ... 350,568
Block. See Tackle block.
Blotter case for copying presses, J. W. Callard ... 350,802
Board. See Bosom board.
Boiler. See Steam boiler.
Boiler, E. V. Hutchens ... 350,592
Boilers, circulating water in, W. Craig ... 350,722
Book cover protector, Stiff & Watrous ... 350,508
Boot for shoes, uniting the sole and heel of, E. J. Le Gay ... 350,540
Bosom board, L. Funk ... 350,732
Bosom board, G. E. Palmer ... 350,551
Bottle holder, S. Frost ... 350,731
Bottle stopper, C. W. Buffum ... 350,801
Bottle stopper, E. H. & C. Morgan ... 350,598
Bottle washer, C. Singer, Jr., *et al* ... 350,643
Box. See Axle box. Call box. Cock box. Paper box.
Brake. See Car brake.
Bricks, etc., composition of matter to be used for preventing discoloration of burned, W. W. Neuer ... 350,550
Bridge, turntable, etc., draw, T. Cooper ... 350,528
Bridle blinder, W. W. Beach ... 350,716
Broom holder, A. M. Bodley ... 350,523
Brush, shaving, G. D. Pushee ... 350,502
Buckle, trace, H. T. Simons ... 350,778
Buggy tops, folding section for, G. W. Crozier ... 350,530
Burner. See Gas burner. Laboratory burner.
Button, M. D. Shipman ... 350,776
Button or other analogous article, J. C. W. Jefferys ... 350,491
Cabinet for prints, books, etc., I. W. Heysinger ... 350,588
Cable grip, T. O. Cooper ... 350,813
Cable gripping device, J. A. Goldstein ... 350,585
Calcimine compound, H. F. Bemendefer ... 350,652
Caliper, inside, W. E. Pettengill ... 350,768
Calipers, micrometer, A. L. Washburn ... 350,513
Calipers, micrometer, W. H. Wilkinson ... 350,516
Call box, multiple, C. Herrmann ... 350,882
Camera. See Photographic camera.
Candle attachment, G. Whyte ... 350,710
Canteen, McKenney & McKeever ... 350,544
Car brake and starter, Morell & Tilton ... 350,890
Bar coupling, J. W. Carley ... 350,527
Car coupling, T. E. Corkhill, Jr ... 350,529
Car coupling, S. H. Harrington ... 350,486
Car coupling, S. G. Howe ... 350,745
Car coupling, W. R. Jenkins, Jr ... 350,746
Car coupling, L. Macy ... 350,756
Car coupling, W. A. Mitchell ... 350,836
Car coupling, A. J. Shipman ... 350,775
Car coupling, W. H. Thurmond ... 350,645, 350,785
Car coupling, Wood & Drake ... 350,518
Car coupling links, machine for making, J. J. Anderson ... 350,859
Car starter and brake, T. & T. Cox, Jr ... 350,661
Cars, brake handle for street, F. B. Brownell ... 350,525
Cars, smoke and cinder deflector for, C. T. Luthy ... 350,888
Carburetor for Argand gas burners, F. B. Strunz ... 350,901
Carriage curtain fastening, H. L. Sanders ... 350,846
Cart, road, I. V. Hicks ... 350,487
Cartridge shells, finishing, H. E. Fowler ... 350,729
Case. See Blotter case.
Cask, brewer's chip, H. Bletzer ... 350,522
Caster, furniture, D. C. Otis ... 350,636
Chandelier, extension gas, B. Churchill ... 350,806
Chimney cowl, T. J. Bradbeer ... 350,800
Chopper. See Clod chopper.
Churn, M. S. Bowser ... 350,524
Chute for branding cattle and horses, N. C. Gillmore ... 350,484
Chute, stock, B. F. & M. M. Watson ... 350,787
Cisterns, device for cleaning, J. B. Kibler ... 350,536
Clamp. See Tube clamp.
Clamp, M. E. Converse ... 350,579
Clod chopper and pulverizer, D. Lubin ... 350,831
Clod crusher, D. Lubin ... 350,832
Clutch, friction, H. Barnes ... 350,798
Coal breaker, E. B. Coxe ... 350,814
Coat and hat rack, F. Westwood ... 350,789
Cock box, water street stop, A. W. Morgan ... 350,891
Coffee pot, A. H. Denis ... 350,818
Combing and mixing bristles, etc., machine for, G. E. Willet ... 350,649
Constant potential regulator, C. Hering ... 350,676
Cooking and renovating apparatus, steam, J. F. Parrish ... 350,637
Corkscrew, W. Schollhorn ... 350,702
Corn husking machine, P. D. Cummings ... 350,620
Corn sheller, Root & Myers ... 350,642
Coupling. See Car coupling. Shaft coupling. Thill coupling. Yoke coupling.
Cowl. See Chimney cowl.
Crusher. See Clod crusher. Rock crusher.
Cuff holder, C. Frank ... 350,622
Cultivator, N. Roggy ... 350,506
Cup. See Oil cup.
Cutter. See Finger nail cutter. Tobacco cutter.
Cutting double piled fabrics, machine for, O. E. Drown ... 350,726
Damper and fire alarm, universal electric, E. A. Morley ... 350,548
Derrick, stacking, A. Gallagher ... 350,824
Dials, making spindles for timepiece, M. V. B. Ethridge ... 350,671
Digger. See Potato digger.
Door and window openings, frame for, J. E. Stuart ... 350,570
Door check, J. W. Ring ... 350,560
Door hanger, J. J. Baldwin ... 350,860
Door hanger, E. T. Prindle ... 350,638
Door hanger, Prindle & Baird ... 350,639
Door hangers, track for barn, J. H. Lawrence ... 350,538
Door spring, R. Hicks ... 350,535
Draught equalizer, A. Curtice ... 350,580
Draw bridge gate, Quatermass & Ellsworth ... 350,696
Driving device, frictional, J. Bachman ... 350,471
Drum head strainer, E. J. Cubley ... 350,870
Egg beater, W. Vickers ... 350,708
Electric cable, underground, B. Williams ... 350,515
Electric circuits, safety cut-out for, E. R. Whitney ... 350,648
Electric lighting system, P. Diehl ... 350,482
Electric machine regulator, dynamo, Loomis & Cooley ... 350,754
Electric motor, P. Diehl ... 350,668
Electric motor or generator, F. E. Fisher ... 350,728
Electric wires, junction clamp for, L. B. Jones ... 350,829
Embossing plate or die, Ferris & Kipp ... 350,876
Embossing rollers, making counterpart, M. Conrath ... 350,481
Emery wheels and hangings therefor, E. R. Hyde ... 350,593
End gate for wagons, H. W. Gary ... 350,734
Engine. See Oscillating engine. Pumping engine. Steam engine.
Envelope counting machinery, A. A. Rheutan ... 350,504
Envelopes, machine for counting and packing, A. A. Rheutan ... 350,505
Fan, L. Biehl ... 350,614
Faucet, R. Marsh ... 350,596
Feed water heater for steam boilers, W. M. Ferry ... 350,820
Fence machines, tension device for wire, S. C. & F. M. Love ... 350,542
Fence supporter, wire, W. C. Gholson ... 350,825
Fence, wire, B. Scarles ... 350,698
File, newspaper, W. Schulz ... 350,507
Filling apparatus, T. H. Hathaway ... 350,675
Filtering apparatus for tanks, cisterns, etc., air, J. Howes ... 350,627
Finger nail cutter, G. H. Coates ... 350,620
Firearm, Johnson & Fyrberg ... 350,681
Fire escape, J. Bien ... 350,473
Fire escape, H. C. Schmidt ... 350,773
Flier, speeder, J. A. V. Smith ... 350,782
Flour chest, J. Ozenberger ... 350,600
Foot wiper or boot and shoe cleaner, W. O. Freytag ... 350,879
Fork, T. Schmitz ... 350,605
Fracture apparatus, W. Bunce ... 350,526
Frame. See Awning frame. Bag or satchel frame.
Freight handling mechanism, D. Stretch ... 350,704
Frogless switch, A. Culp ... 350,662
Furnace. See Hot air furnace. Smoke consuming furnace.
Furnaces, apparatus for charging blast, J. M. Gettel *et al* ... 350,534
Furniture, school, J. C. Camburn ... 350,803
Gauge. See Steam and water gauge.
Game counter, W. B. Carpenter ... 350,577
Gas burner, Dawes & Haarlander ... 350,815
Gas compressor, W. Bowers ... 350,862
Gate. See Draw bridge gate. End gate. Railway crossing gate.
Gate, H. O. Thomas ... 350,571
Generator. See Steam generator.
Governor, W. D. Marks ... 350,595
Governor, engine, W. Arnot ... 350,797
Grating, coal vault, E. Maratta ... 350,757
Grenade extinguisher, hand, R. H. C. Valentine ... 350,647
Grinding mill, H. F. Stone ... 350,599
Gun cleaner, C. A. Sherman ... 350,847
Hair pins, machine for making, G. A. Spratt *et al.* 350,900

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Hammock, J. K. Fox 350,878
Handle. See Auger handle.
Hanger. See Door hanger.
Harness, J. H. Whitaker 350,854
Harrow, J. A. Kern 350,683
Harrow and cultivator, combined, D. Kessler 350,684
Harrow and cultivator tooth, T. E. Davies 350,724
Harrow, reversible, W. S. Pates 350,893
Harvester and thrasher, combined, J. P. Descalzo 350,667
Harvester, grain binding, O. Cooley 350,812
Hat and coat hook, W. R. Clark 350,809
Hat holder, C. Higbee 350,743
Hat ventilator, J. Basch 350,651
Hay carriers, turntable for, E. Woodward 350,855
Hay press, W. H. Bryant 350,476
Hay press, B. J. Curry 350,663
Hay press, A. Simpson 350,898
Hay rack, A. L. Bingham 350,474
Hay rake, horse, G. K. Schauer 350,669
Hay tedder, P. A. Spicer 350,566
Heater. See Feed water heater.
Heel counter, L. Cote 350,618
Heel stiffener machine, W. J. Young 350,907
Hinge, lock, O. H. Taylor 350,851
Holder. See Bottle holder. Broom holder. Cuff holder. Hat holder. Printing plate holder. Sash holder. Sewing machine needle holder.
Hook. See Hat and coat hook. Whiffletree hook.
Horseshoe, P. Pitton 350,840
Horseshoe machine, F. A. Roe 350,603
Hot air furnace, C. S. Hood 350,590
Hot air furnace, J. F. Pease 350,601
Hotel call, fire alarm, and indicator, Hess & Stoltenberg 350,626
Hydrocarbons, apparatus for the combustion of liquid, P. Tarbutt 350,783
Index, M. B. Smyth 350,848
Indicator. See Station indicator.
Inhaler, E. B. Adams 350,711
Injector, W. T. Messinger ..... 350,545 to 350,547
Insecticide, R. McKee 350,690
Insulator pins for telegraphic purposes, machine for manufacturing, C. Rogers 350,843
Iron. See Smoothing and polishing iron.
Jack. See Lifting jack.
Japanning apparatus, F. Crane 350,869
Joint. See Railway rail joint.
Journal bearing, G. M. Kernodle 350,749
Key fastener, D. T. Phillips 350,589
Knife. See Wood working machinery knife.
Knife cleaning and scouring apparatus, T. B. Osborne 350,838
Knitting machine, F. Wilcomb 350,793
Knitting machine, straight, F. Wilcomb 350,795
Knitting machines for shaping fabrics, operating the needles and transfer points in latch needle, F. Wilcomb 350,791
Knitting machines, movable cam for straight, F. Wilcomb 350,794
Knitting machines, needle operating cam for, F. Wilcomb 350,792
Knob attachment, J. Bardsley 350,714
Knob attachment, W. R. Briggs 350,576
Knob spindles, fastening for, C. E. Whittlesey 350,609
Labeling machine, F. X. Spitznagel 350,899
Laboratory burner, Allender & Henderson 350,796
Lamps and other articles, suspension device for, J. D. Griswold 350,673
Lamps, cut-out for electric, L. G. Woolley 350,519
Lamps, etc., suspending device for, C. H. Lyman 350,495
Latch, reversible, C. H. Montgomery 350,691
Lath strip, C. P. Jacobs 350,488
Leather skiving machine, E. A. Latham 350,753
Lifting jack, M. C. Meeker 350,597
Lixiviation and similar compounds, separating products of, Endlich & Muhlenberg 350,670
Lock. See Nut lock. Sash lock. Seal lock.
Lock, E. Hambujer 350,788
Lock, C. R. Uhlmann 350,573
Locomotive spring, Illingworth & Smiley, Jr., 350,629, 350,630
Looms, let-off motion for, R. Brown 350,475
Lounge, Holland & Dohan 350,589
Lubricator. See Axle lubricator.
Malting and drying apparatus, J. F. Baldwin 350,472
Mat. See Picture mat.
Measure, liquid, J. S. Cole 350,810
Measuring device, grain, W. J. Ricards 350,508
Measuring fluids under pressure, device for, H. Hammerschmidt 350,826
Mechanical movement, E. Clement 350,479
Medicine, remedy for kidney diseases, F. E. Chadwick 350,867
Metal bars, machine for coiling, J. J. Anderson 350,612
Meter. See Water meter.
Mill. See Grinding mill. Sawmill.
Mines, shutter or door for, G. W. Nation 350,599
Motor. See Electric motor. Petroleum and gas motor.
Mowers, cutter bar connection for, W. H. De Vault 350,531
Music sheet for mechanical musical instruments, perforated, G. B. Kelly 350,747
Music sheet, perforated, G. B. Kelly 350,748
Musical instrument, mechanical, O. P. Lochmann 350,541
Musical instruments, key board for, W. T. Weir 350,788
Nails, machine for pointing wire, A. Newton 350,837
Navigating in foggy weather, F. D. Torre 350,608
Navigation, disclosing obstacles to, F. D. Torre 350,817
Necktie fastener, J. French 350,672
Necktie fastener, F. Standish 350,703
Numbering machine, consecutive, J. H. Reinhardt 350,640
Nut lock, Freeman & Whitehead 350,533
Nut lock, W. S. Harris 350,827
Nuts and other portions of machinery, retainer for, C. Driscoll 350,725
Oil cup, J. Sladden 350,779
Oil on seas, apparatus for distributing, F. D. Montague 350,889
Ore, reducing unsmelted or partly smelted, J. T. Wainwright 350,574
Ores and other materials, machine for pulverizing, A. M. Rouse 350,564
Ores, extracting metals from, Endlich & Muhlenberg 350,669
Ores, machine for reducing, A. M. Rouse 350,563
Organ, reed, J. B. Hamilton 350,623, 350,624, 350,739
Oscillating engine, Y. Lusse 350,633
Packer for oil wells, J. D. Brooder 350,655
Paint, J. H. Palmer 350,765
Pan. See Ash pan.
Paper box, folding, C. W. Elliott 350,727
Paper calendering machines, sheet feeding device for, L. Harlow 350,741
Paper making machine, R. Smith 350,607
Paper receptacle, D. B. Cole 350,808
Paper tubes, machine for making, M. D. Knowlton 350,830
Petroleum and gas motor, Ragot & Smyers 350,769
Photographic camera, J. S. Johnston 350,682
Piano key board support, F. L. Wing 350,517
Pianos, damper for upright, J. Herrburger 350,625
Picture mat, Simmons & Hall 350,777
Pin. See Safety pin.
Pistol, breech-loading magazine, C. J. Schoening 350,565
Plane, bench, F. M. Bailey 350,613
Planer table cushioning device, F. Phillips 350,555
Planing machine cushioning device, F. Phillips 350,554
Planing machine, wood, G. S. Myrick 350,892
Planter, W. Lewis 350,686
Planter, combined corn and cotton, W. E. Kennedy 350,887
Planter, corn, G. Laning 350,752
Planters, check rower for corn, C. S. Howard 350,591
Plow, B. Butler 350,864
Plows, seed planting and fertilizer distributing attachment for hand, H. F. Miley 350,835
Pot. See Coffee pot.
Potato digger, W. T. Garrett 350,733
Press. See Hay press. Silo press.
Pressing and dampening machine, D. Walters 350,786
Printing plate holder, M. J. Hughes 350,677
Printing rollers, making matrices for, E. P. Benjamin 350,654
Printing rolls, making gelatine, E. P. Benjamin 350,653
Protector. See Book cover protector.
Pulverizer, cultivator, and road scraper, combined, A. Neutascher 350,762
Pulverizing roller and attachment, clay, H. R. Hopkins 350,744
Pump, M. M. Chew 350,805
Pump, E. Neff 350,761
Pump, double acting, T. Dyson 350,875
Pump, double acting, H. S. Ramsey 350,770
Pump, steam, J. T. Leftwick 350,632
Pump, steam, H. J. Oliver 350,763
Pumping engine, steam, J. L. Lowry 350,755
Pyroxyline, manufacture of, G. M. Mowbray, 350,497, 350,498
Rack. See Coat and hat rack. Hay rack.
Radiators, air valve for, E. K. Rollins 350,844
Rails, rolls for reducing old, S. McCloud 350,833
Rails to flat plates, rolling old, J. Reese 350,557
Rails to street rails, rolling old, J. Reese 350,558
Railway crossing gate, Kleckner & Coates 350,750
Railway frog, A. J. Moxham 350,549
Railway rail joint, T. A. Davies 350,666
Railway rails, fish plate for, T. A. Davies 350,665
Railway rails, manufacturing, W. R. Jones 350,594
Railway signal, P. J. Wicks 350,790
Railway tie or support, J. K. Clark 350,478
Rake. See Hay rake.
Rammer for street paving, J. G. Schmidt 350,700
Regulator. See Constant potential regulator. Electric machine regulator.
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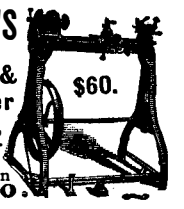

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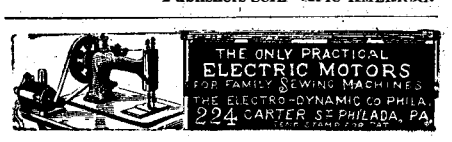

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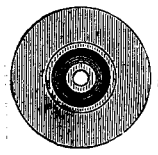
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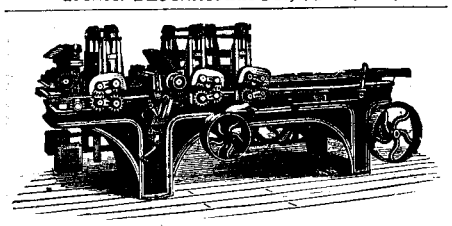
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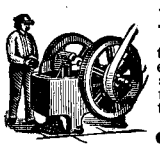
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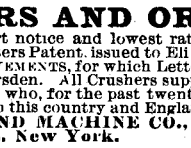
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TO THE STEEL MANUFACTURERS OF THE UNITED STATES OF AMERICA.

UNITED STATES NAVY DEPARTMENT,
WASHINGTON, D. C., Aug. 21, 1886.

The attention of all steel manufacturers of the United States is hereby invited to the requirements of the Navy Department in the way of armor-plates and heavy gun forgings, for the prosecution of work already authorized by Congress.

This advertisement invites all domestic manufacturers of steel to specify, in competition with each other, upon what terms they will engage to prepare for the production of and produce the forgings and armor-plate required for modern ordnance and armored ships; and no bids will be considered except such as engage to produce within the United States either all the gun-steel or all the armor-plate (or both) specified in this advertisement; nor will any bid be accepted unless accompanied by evidence satisfactory to the Department that the bidder is in possession of, or has made actual provision for, a plant adequate for its fulfillment.

Bids are hereby invited for supplying this Department with the under-mentioned material:

About 1,310 tons of steel gun-forgings, of which about 328 tons will be for guns of six inches caliber, 70 tons for guns of eight inches caliber, and 912 tons for calibers between ten inches and twelve inches (both inclusive).

These forgings are to be delivered rough bored and turned, and when in that state the heaviest forging which enters into the construction of a gun of each of the desired calibers will be about as follows:

6-inch	3¼ tons.
8 "	5 "
10 "	9½ "
10½ "	9½ "
12 "	12½ "

All these forgings must be delivered within the following times from the closing of a contract, viz.:

For 6 inch guns, 28 within one year, and the remainder within 18 months.

For 8 inch guns, within two years.

For 10 inch and larger guns, within 2½ years.

Preference will be given for earlier deliveries.

Also, about 4,500 tons of steel armor-plates, to be of the best material and manufacture, shaped accurately after patterns to fit the form of each vessel for which intended, and of such sizes as may be required, varying somewhat as follows:

20 feet by 8 feet by 12 inches thick.
17½ feet by 6 feet by 17 inches thick.
11½ feet by 4½ feet by 6 inches thick.
There will also be thinner plates.

For information concerning shapes and weights of the gun forgings and armor-plates, what parts must be manufactured in sets, time of delivery of each set, the chemical, physical, and ballistic tests, which the metal must sustain in each case, and for all other particulars, apply to the Chief of Bureau of Ordance, Navy Department, Washington, D. C.

Each bid upon armor-plate must specify the time within which the bidder will engage to make delivery; and preference will be given to earliest proposed deliveries.

Proposals must be in duplicate, sealed and addressed to the Secretary of the Navy, Navy Department, Washington, D. C., the envelopes indorsed "Proposal for steel gun-forgings and armor."

They will be received at the Navy Department until 12 o'clock M. on the 10th day of December, 1886, at which hour the opening of the bids will take place.

The right is reserved to waive defects in the form of, and to reject any or all bids.

Ten per cent. of the contract price will be retained from the payment for each article delivered, until the contract, as far as relates to articles of that class, shall have been completed.

Separate bids may be submitted for the gun steel and for the armor, if any manufacturer so desires; but bids covering both will receive preference, other things being equal.

Bids will be compared in two classes.

First. Gun Forgings.

Second. Armor-plate.

And the total sum for which, and the time within which the whole of the material covered by each class will be produced and delivered will be alone considered.

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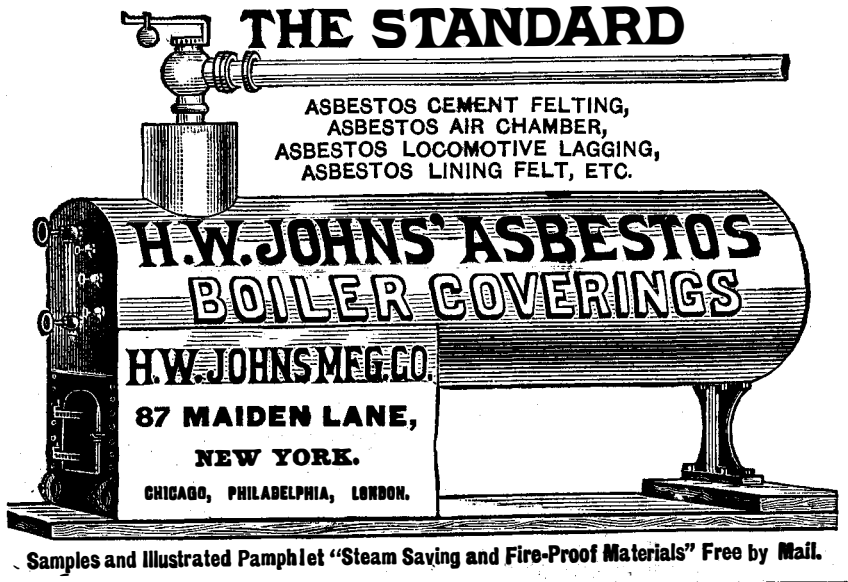

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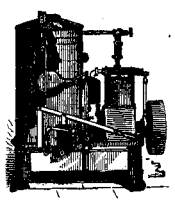

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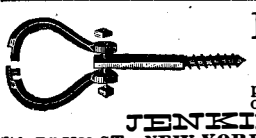

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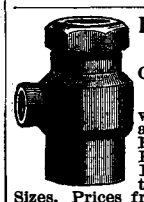

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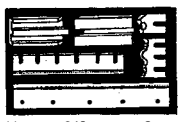

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